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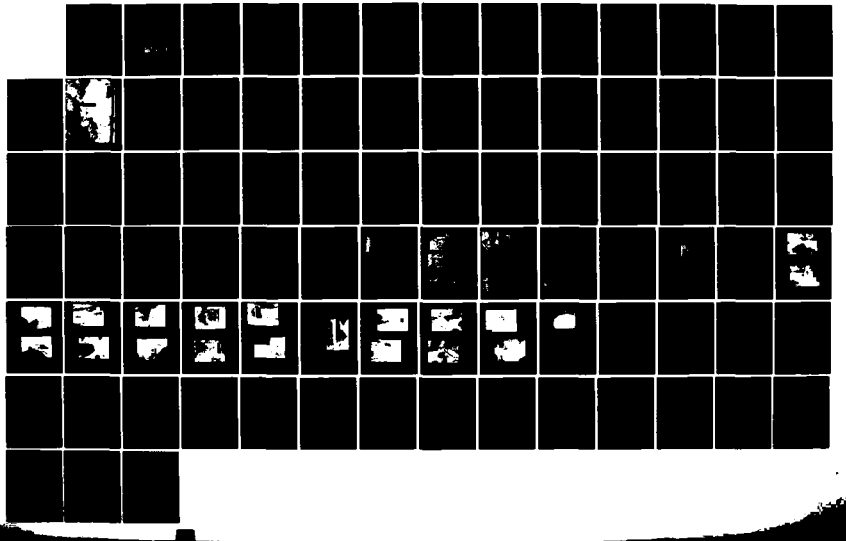
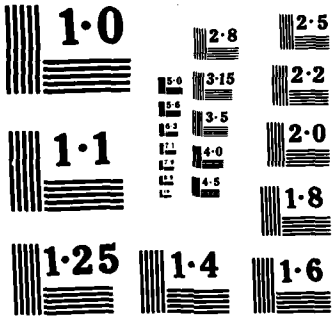




MERRIMACK RIVER BASIN

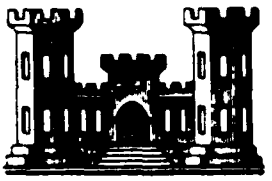
PEMBROKE, NEW HAMPSHIRE

BUCK STREET WEST DAM

NH 00444

NHWRB NO. 190.05

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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FEBRUARY 1979

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Pembroke, New Hampshire
Suncook River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a composite structure consisting os concrete stone and earth with an overall length of about 143.8 ft. with a maximum height of 12 ft. The dam is generally in fair condition. There are a few concerns which need attention. It is small in size with a low hazard potential. The non overflow section would be overtopped by 9.0 ft. under test flood conditions.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF
NEDED

MAY 2 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Buck Street West Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

BUCK STREET WEST DAM

NH 00444

NHWRB 190.05

MERRIMACK RIVER BASIN
PEMBROKE, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LETTER OF TRANSMITTAL

FROM THE CORPS OF ENGINEERS TO THE STATE

TO BE SUPPLIED BY THE CORPS OF ENGINEERS

NATIONAL DAM INSPECTION PROGRAM
PHASE I - INSPECTION REPORT
BRIEF ASSESSMENT

Identification No.:	00444
Name of Dam:	Buck Street West Dam
Town:	Pembroke
County and State:	Merrimack, New Hampshire
Stream:	Suncook River
Date of Inspection:	November 16, 1978

Buck Street West Dam is a composite structure consisting of concrete, stone and earth with an overall length of approximately 143.8 feet and a maximum structural height of about 12 feet. The dam was originally constructed in 1923. Engineering data available consisted of a set of plans dated 1961 and 1962 showing plans and details of the additions and improvements made to the dam in about 1962. No construction specifications or design calculations were available.

The visual inspection indicated that the dam is in generally fair condition. The inspection revealed minor seepage at the downstream toe of the embankment next to the stoplog sluiceway structure and some rust-staining and a small clump of swamp grass (which are evidence that some seepage has discharged at the location even though no water was evident at the time of the inspection) at the downstream toe of the embankment next to the east end of the concrete section of the dam. Also, the inspection revealed insufficient vegetation growing at the crest of the dam, concrete deterioration of the spillway and training walls including cracking, spalling and loss of section and some minor log debris in the downstream channel.

Based on its small size and low hazard classification in accordance with the Corps guidelines the test flood is equal to a 100 year storm. The spillway will pass only about 25 percent of the test flood and is considered inadequate. The nonoverflow section would be overtopped by 9.0 feet under test flood conditions.

It is recommended that the owner engage a qualified engineer to investigate the seepage conditions where the embankment sections abut the concrete section of the dam and to design remedial or control measures as needed. Provisions should be made by the owner to monitor the seepage weekly until permanent remedial or control measures are implemented, establish vegetation on the crest of the embankment, repair the deteriorated concrete spillway section and to clean the downstream channel.

The recommendations and remedial measures are described in Section 7 and should be addressed within one year after receipt of this Phase I - Inspection Report by the owner.

Gordon H. Slaney, Jr.

Gordon H. Slaney, Jr., P.E.
Project Engineer

Howard, Needles, Tammen & Bergendoff

This Phase I Inspection Report on Buck Street West Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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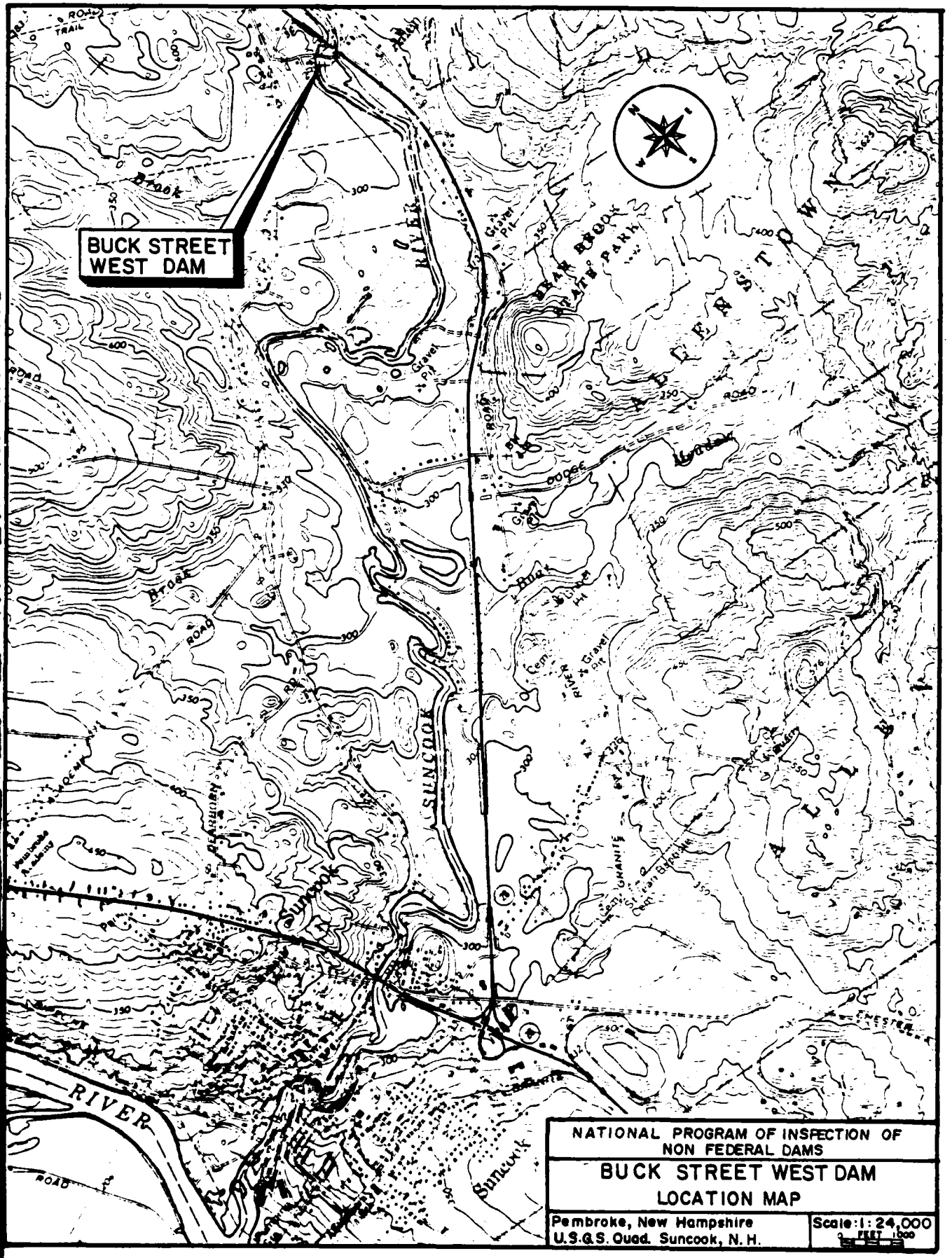
APPENDIXES

PUCK STREET WEST DAM - Overview looking upstream



NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

BUCK STREET WEST DAM
LOCATION MAP

Pembroke, New Hampshire
U.S.G.S. Quad. Suncook, N.H.

Scale: 1:24,000
0 FEET 1000

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
BUCK STREET WEST DAM

SECTION I
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Howard, Needles, Tammen & Bergendoff has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Howard, Needles, Tammen & Bergendoff under a letter of October 23, 1978, from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0356 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Buck Street West Dam is located on the Suncook River, approximately 5.3 miles upstream from its confluence with the Merrimack River, in the Town of Pembroke, New Hampshire. The dam is shown on U.S.G.S. Quadrangle Suncook, New Hampshire, with coordinates approximately N43°09'36", W71°24'25", Merrimack County, New Hampshire. The location of Buck Street West Dam is shown on the Location Map immediately preceding this page.

b. Description of Dam and Appurtenances. Buck Street West Dam is a composite structure consisting of concrete, stone and earth. The dam's length, including abutment core walls, is approximately 143.8 feet. The maximum structural height of the dam, according to existing plans, is about 12 feet. This dam, originally constructed in 1923, was reconstructed by the New Hampshire Water Resources Board in 1962. The present dam has a concrete gravity spillway, outlet works and abutments consisting of a concrete-stone structure with concrete core walls extending into the embankments.

The appurtenant structures consist of a spillway with flash boards, outlet works structure consisting of sluiceway with stop logs and a discharge channel. The outlet works structure is located in the right abutment of the dam.

Figure 1, located in Appendix B, shows the plan of the dam and its appurtenant structures. Photographs of each structure are shown in Appendix C.

c. Size Classification. Small (hydraulic height - 12 feet high, storage - 413 acre-feet) based on both storage being less than 1000 acre-feet, and height being less than 40 feet as given in Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. The dam's potential for damage rates it as a low hazard. A major breach of the West Dam could result in some minor flooding to a trailer park located 400 feet downstream of the dam. Three miles downstream of the dam there are about 7 dwellings which could expect flooding as a result of a dam failure. The increased effect from breach of dam would probably be minimal and no loss of life, due to a dam breach, would be expected.

e. Ownership. This dam is owned by the New Hampshire Water Resources Board, Concord, New Hampshire 03301.

f. Operator. This dam is maintained and operated by the State of New Hampshire Water Resources Board, 37 Pleasent Street, Concord, New Hampshire 03301. Chairman of the Water Resources Board is Mr. George M. McGee, Sr.; Mr. Vernon Knowlton is Chief Engineer. Telephone No. (603)271-1110.

g. Purpose of Dam. This dam is used for recreational purposes for the State Park located just upstream of the dam.

h. Design and Construction History. The dam at Buck Street West was originally constructed in about 1923 for the Suncook Mills Company to regulate the supply of water for power generation. No plans of the original construction are available. About 1969 the outlet works structure was reconstructed, the abutments were re-faced, and the spillway patched according to plans and specifications prepared by the New Hampshire Department of Fish and Game. No in-depth design data were disclosed for this dam.

i. Normal Operating Procedure. No written operational procedures were disclosed. In normal operation the stoplogs in the outlet works are removed in mid October to lower the river to channel bed elevation. Placement of the stoplogs is sometimes dependent on the Buck Street East Dam as its gates can be opened to lower the water level. In the spring, the stoplogs are replaced. During the summer months the water level is controlled by the spillway elevation, thus producing the recreational pool for the State Park.

1.3 Pertinent Data

a. Drainage Area. The drainage area tributary to Buck Street West Dam consists of approximately 240 square miles of flat to rolling, wooded terrain. Pittsfield is the only major town within the watershed. Topographic elevation in the basin ranges from a maximum of 2384 to 240 feet MSL.

As this is a "run of the river" type dam the reservoir area is very small in comparison to the whole watershed. The surrounding area is wooded with little variation in contour. Route 28, a major highway, crosses the Suncook River approximately 150 feet upstream of the dam. The abandoned Buck Street bridge crosses 100 feet upstream. There are many large logs and stumps along the upstream river bank.

b. Discharge at Dam Site

(1) The outlet works for the Buck Street West Dam consists of three $4.0^{\pm}$ foot wide stoplog sluiceways. The reservoir behind the dam can be lowered about 7 feet below the spillway crest elevation (286.2) by the removal of the wooden stoplogs in the sluiceway. Removal of all stoplogs will lower the reservoir level to the original river bed elevation of 279.6.

(2) The maximum discharge at the Buck Street site is estimated to have been 18,500 cfs during the March 1936 flood. As the Buck Street West Dam is hydraulically interconnected with the Buck Street East Dam, it is estimated that the Buck Street West Dam passes approximately 82 percent of the river flow.

(3) The spillway capacity with the water surface at the top of dam is approximately 3755 cfs at elevation 291.3.

(4) The spillway capacity with the water surface at the test flood elevation of 300.45 is approximately 11,640 cfs.

(5) The total project discharge for the West Dam is 14,890 cfs at elevation 300.45. It should be noted that the full test flood discharge at Buck Street flows over both the Buck Street West Dam and the Buck Street East Dam. Further details are given in Section 5 of this report.

c. Elevation (feet above MSL)

(1) Streambed at centerline of dam - 279.6.

(2) Maximum tailwater - 297.3 (est.).

(3) Upstream portal invert diversion tunnel - none.

(4) Recreation pool - 286.2.

(5) Full flood control pool - N/A.

(6) Spillway crest (permanent spillway) - 286.2.

(7) Design surcharge - unknown.

(8) Top Dam - 291.3.

(9) Test Flood Surcharge - 300.45.

d. Reservoir (Miles)

(1) Length of Maximum Pool - N/A.

(2) Length of Recreational Pool - N/A.

(3) Length of Flood Control Pool - N/A.

e. Storage (Gross Acre-Feet)

(1) Recreation Pool - 84.

(2) Flood Control Pool - N/A.

(3) Spillway Crest Pool - 84.

(4) Top of Dam - 413.

f. Reservoir Surface (Acres)

(1) Recreation Pool - 43.

(2) Flood Control Pool - N/A.

(3) Spillway Crest - 43.

(4) Test Flood Pool - 120.

(5) Top Dam - 69.

g. Dam

(1) Type - concrete gravity dam.

(2) Length - 143.8 feet, overall.

(3) Height - 11.75 feet (maximum).

(4) Top Width - 12 across abutments.

(5) Side Slopes - US = Variable; DS = variable.

(6) Zoning - unknown.

(7) Impervious core - none.

(8) Cutoff - unknown.

(9) Grout Curtain - unknown.

(10) Other - none.

h. Diversion and Regulating Tunnel

None.

i. Spillway

(1) Type - concrete ogee.

(2) Length of Weir - 74.0 feet.

(3) Crest Elevation - 286.2.

(4) Gates - none.

(5) U/S Channel - none.

(6) Downstream Channel. The channel immediately downstream of the dam is the westerly channel of the Suncook River. The channel is approximately 100 feet wide with a rock bottom. The channel does not increase substantially in width when it joins the easterly channel about 400 feet downstream of the dam.

j. Regulating Outlets. River level is regulated by three gates 3.88, 4.23 and 3.88 feet wide. These gates are set on a concrete platform near the stream invert at elevation 279.6. Control is accomplished by stoplogs which can be set individually for each gate.

SECTION 2
ENGINEERING DATA

2.1 Design

The dam at Buck Street West was originally constructed in about 1923 for the Suncook Mills Company to regulate the supply of water for power generation. No plans or design data for the original construction are available. In 1962, the dam was reconstructed by the State of New Hampshire Water Resources Board in conjunction with the Department of Fish and Game. A set of drawings (10 sheets) dated 1961 and 1962 showing plans and details of the additions and improvements to the existing dam is the only design information found. No in-depth engineering calculations were found.

2.2 Construction

No construction records were available for use in evaluating the dam.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. Engineering data available for Buck Street West Dam is limited to the set of drawings mentioned above. These plans are on file at the State of New Hampshire Water Resources Board.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

c. Validity. The field investigation indicated that the external features of Buck Street West Dam substantially agree with those shown on the available plans.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Buck Street West Dam was made on November 16, 1978. The inspection team consisted of personnel from Howard, Needles, Tammen & Bergendoff and Geotechnical Engineers, Inc. A representative of the State of New Hampshire Water Resources Board was also present during the inspection. Inspection checklists, completed during the visual inspection are included in Appendix A. At the time of the inspection, the water level was approximately 37 inches below the permanent spillway elevation. No water was passing over the spillway. The upstream face of the dam could only be inspected above this water level.

b. Dam. Visual inspection indicates that the dam is in good condition (with respect to the geotechnical aspects - foundation, abutments, embankment sections between concrete section of dam and abutments).

Foundation of Concrete Section of Dam

Bedrock is visible beneath the tailwater surface at the downstream toe of the concrete dam, and it appears that the entire length of the concrete section of the dam is founded on bedrock. To the extent that it is visible beneath the tailwater surface, the bedrock appears to be in sound condition. There was no visible evidence of large seepage underneath the concrete section of the dam, although minor seepage could be occurring and not be visible because of the tailwater.

Junction Between Concrete and Embankment Sections of Dam

At the time of the inspection, minor seepage was occurring at the downstream toe of the embankment next to the stoplog spillway structure at the west end of the concrete section of the dam (Photo 17). The water discharging at this location was clear, and there was no evidence that any soil had been washed out of the embankment by the discharging seepage.

At the downstream toe of the embankment next to the east end of the concrete section of the dam, there was some rust-staining and a small clump of swamp grass, which are evidence that some seepage has discharged at this location even though no water was evident at the time of the inspection (Photos 14

and 15). There was no evidence that any soil had been washed out of the embankment by the discharging seepage.

Embankment Section at East End of Dam

The embankment section at the east end of the dam has a concrete core wall which is 12 inches wide and extends for a distance of 12 feet from the concrete-encased stone abutment at the east end of the dam toward the east abutment. A drawing dated 1962 indicates that this wall was to be founded on "ledge" and that a "rock fill" was to be placed to a depth of about 2 feet on the downstream slope against the concrete cut-off wall. The top of the wall was visible at the time of the inspection and appeared to be in good condition. The rockfill on the downstream slope consists of rocks about 1 to 3 feet in size which appear to have been hand-placed.

About a foot of clean sand and gravel appears to have been placed recently on the crest of the embankment. There is very little vegetation growing on the crest.

Embankment Section at West End Dam

The embankment section at the west end of the dam has a concrete core wall which is 12 inches wide and which extends on a dogleg alignment about 28 feet from the stoplog spillway structure to the west abutment. A drawing dated 1962 indicates that this wall was to be founded on ledge and that a "stone fill" was to be placed on the downstream slope of the embankment. The top of the wall was visible at the time of the inspection and appeared to be in good condition. The downstream slope is paved with hand-placed cut stone as shown in Photo 9.

Clean sand and gravel appears to have been placed recently on the crest of the embankment.

c. Appurtenant Structures. Visual inspection of the concrete spillway, outlet works structure and spillway/outlet works discharge channel did not disclose any finding indicating an immediate unsafe condition. However, inspection of the downstream face of the spillway structure indicated that the concrete surface has experienced considerable deterioration. Concrete spalling, some loss of section and cracks were noted on the concrete spillway (Photos 6 and 7).

The spillway consists of a gravity concrete section as shown in Figure 1, located in Appendix B, and Photos 3, 5 and 7. Field inspection of the spillway surface indicated that since original construction, the concrete has deteriorated

in the form of cracks, spalling and some loss of section. Both spillway training walls have numerous horizontal and vertical cracks above the spillway crest. The spillway structure is considered to be in fair condition.

The outlet works consist of a sluiceway (Photo 8 and 10) formed by two stone-masonry pier walls with concrete facing (Photo 10, 11 and 13), and removable wooden stoplogs supported by the walls and two vertical steel I-beams. The top of the sluiceway structure is covered with a concrete slab. The maximum effective sluiceway opening is 10.7 feet wide by 11.8 feet high. The pier wall between the spillway and sluiceway (Photo 11) has exposed reinforcing steel. This reinforcing steel appears to have been left exposed for a possible extension of the concrete facing. The walls and the stoplogs are in generally good condition.

d. Reservoir Area. The reservoir area at the Buck Street site is insignificant in terms of impoundage as both dams at this site are primarily run of the river type dams. The area in the vicinity of the dam consists of rolling, wooded terrain with some fields scattered throughout the area. A major state roadway (Route 28) crosses the river approximately 150 feet upstream of the dam. The abandoned Buck Street bridge crosses the river about 100 feet upstream of the dam. There were many large logs and stumps noted along the shores of the river.

e. Downstream channel. Visual inspection of the spillway/outlet works discharge channel showed it to be in good condition. The downstream channel is primarily bedrock with some boulders and a small amount of sand and gravel on the bottom. Some brush is growing and there are several logs in the channel that would appear to obstruct, to some degree, free flow of the channel discharge. The main Suncook River, beyond where the east and west branches join, appeared to be relatively clean with tree lined banks.

3.2 Evaluation

Visual examination indicates that the dam is in generally fair condition. The inspection revealed the following:

(a) Minor seepage at the downstream toe of the embankment next to the stoplog sluiceway structure.

(b) At the downstream toe of the embankment next to the east end of the concrete section of the dam, there was some rust-staining and a small clump of swamp grass, which

are evidence that some seepage has discharged at the location even though no water was evident at the time of the inspection.

(c) Insufficient vegetation growing at the crest of the dam.

(d) Concrete deterioration of the spillway and training walls including cracking, spalling and loss of section.

(e) Some minor log debris in the downstream channel.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedure

The Buck Street West Dam is used primarily to create an impoundment of water on the Suncook River, which impoundment is used for recreational purposes. The normal operational procedure for this dam is to open the sluice gates in the outlet works structure in about October of each year, allowing the water level to be maintained at the natural river channel elevation during the winter months. In the spring, the stoplog gates are closed. During the summer months the water level is controlled by the spillway elevation, thus producing the recreational pool. It should be noted that the Buck Street West Dam is hydraulically interconnected with the Buck Street East Dam as they are separated only by an island in the Suncook River channel.

4.2 Maintenance of Dam

This dam is visited by one of the State of New Hampshire Water Resources Board's dam operators approximately once per week. During these visits water levels are recorded, brush is cut as necessary, painting is done as necessary and any major deficiencies that may be noted are reported to the Water Resources Board.

4.3 Maintenance of Operating Facilities

Maintenance on the outlet works facilities is done on an as needed basis.

4.4 Description of Warning Systems

There are no warning systems in effect at this facility.

4.5 Evaluation

The current operation and maintenance procedures for Buck Street West Dam are inadequate to insure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written operation and maintenance procedure as well as establishing a warning system to follow in event of flood flow conditions or imminent dam failure.

SECTION 5
HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features

a. General. Buck Street West Dam is a composite structure consisting of concrete, stone and earth, having a total length of approximately 143.8 feet and a maximum structural height of about 12 feet. The appurtenant structures consist of a spillway section and an outlet of 74 feet wide by 5 feet high. The outlet works consists of three 4 foot wide stoplog sluiceways located at the right abutment of the dam.

The dam is located on the Suncook River and creates an impoundment of water primarily used for recreational purposes. The Buck Street West Dam is hydraulically interconnected with the Buck Street East Dam as they are separated only by an island in the channel of the Suncook River. Buck Street West Dam is classified as being small in size having a maximum storage of about 413 acre-feet.

b. Design Data. No hydrologic or hydraulic design data were disclosed for the Buck Street West Dam.

c. Experience Data. The maximum flow of 18,500 cfs for the March 1936 flood was estimated from the recorded maximum flow of 12,900 cfs at Chichester, New Hampshire. As indicated above, the Buck Street West Dam is hydraulically interconnected with the Buck Street East Dam. The Buck Street West Dam passes approximately 82 percent of river flows. No water level records were in evidence for the Buck Street location.

d. Visual Observations. No evidence of damage to any portion of the project from overtopping was visible at the time of the inspection.

e. Overtopping Potential. As no detailed design or operational information are available, hydrologic evaluation was performed using dam information gathered by field inspection, watershed size and an estimated test flood equal to the flood of record or approximately 1/4 the Probable Maximum Flood (PMF). Based on a drainage area of 240 square miles the test flood inflow at the Buck Street site was estimated to be 18,500 cfs. At this point it is noted that the 18,500 cfs test flood discharge is

for the Buck Street West Dam as well as the Buck Street East Dam which is located 150 feet to the east of the West Dam. These dams are hydraulically interconnected as they are separated only by an island in the channel of the Suncook River. Following the guidance given for estimating the effect of surcharge storage on the test flood discharge results in a peak outflow of 18,310 cfs. Approximately 82 percent of the test flood passes on the west side of the island. As the maximum spillway capacity of the Buck Street West Dam is only 3755 cfs (approximately 25 percent of the westerly test flood flow) the Buck Street West Dam will be overtopped by 9.15 feet. As this dam is a low "run of the river" type dam it is subjected to backwater conditions. The estimated tailwater for the test flood was accounted for in the surcharge analysis.

f. Dam Failure Analysis. The impact of failure of the dam at maximum pool (top of dam) was assessed using the "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis included the reach of river from the dam to the Route 3 bridge in Suncook, New Hampshire. Failure of the dam at maximum pool would probably result in an increase of about 1.5 feet over the stage resulting from discharge at full spillway flow, or from 9.6 to 11.0 feet. The full spillway discharge downstream also includes flow from the East Dam. It should be noted that the downstream stage for the test flood is estimated to be 18 feet.

The increase in flow from breach of dam could result in some minor flooding in a trailer park (not shown on U.S.G.S. map) located 400 feet downstream of the dam. Approximately 3 miles downstream of the dam there are about 7 dwellings located on the banks of the Suncook River that would experience flooding due to the flows that would be expected from full spillway conditions. The effect from breach of dam would probably be minimal and no loss of life due to a dam breach, would be expected.

Channel storage will attenuate the flood wave so that it will be insignificant when compared to channel flows by the time it reaches the Route 3 bridge in Suncook.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The concrete section of the dam appears to be founded on bedrock and there were no visible signs of conditions that might cause instability.

Minor seepage is occurring at the toe of the embankment section close to the east end of the concrete dam and also at the toe of the other embankment section close to the spillway structure at the west end of the dam. Neither of these seepages is considered to be an immediate hazard to the structural stability of the embankment sections.

There is little or no vegetation on the crest of the two embankment sections, which reduces the resistance of the embankment to erosion if it should be overtopped. However, some erosion resistance would be provided by the concrete core wall in each embankment section which extends part way from the concrete section of the dam to each abutment, and by the riprap on the downstream slope of each embankment.

b. Design and Construction Data. Buck Street West Dam was built in 1923 and underwent extensive rehabilitation in 1962. Design drawings are available for the 1962 rehabilitation. The drawings indicate that the concrete section of the dam is founded on "ledge". They also show that the east embankment section has a concrete core wall which is 12 inches wide and extends for a distance of 12 feet from the concrete-encased stone abutment at the east end of the dam toward the east abutment, and that the west embankment section has a concrete core wall which is 12 inches wide and extends on a dogleg alignment about 28 feet from the stoplog spillway structure to the west abutment. The drawings indicate that "stone fill" was placed in both embankments on the downstream side of the core walls.

c. Operating Records. No operating records were available for evaluation.

d. Post-Construction Changes. As noted above, the original dam was built in 1923 and extensive rehabilitation was carried out in 1962. The only apparent change since

the 1962 rehabilitation is the placement of clean sand and gravel on the crest of the two embankment sections.

e. Seismic Stability. The dam is located in Seismic Zone 2, and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual inspection indicates that the Buck Street West Dam is in generally fair condition. The inspection revealed the following:

(1) Minor seepage at the downstream toe of the embankment next to the stoplog sluiceway structure.

(2) At the downstream toe of the embankment next to the last end of the concrete section of the dam, there was some rust staining and a small clump of swamp grass, which are evidence that some seepage has discharged at this location even though no water was evident at the time of the inspection.

(3) Insufficient vegetation growing at the crest of the dam.

(4) Concrete deterioration of the spillway and training walk including cracking, spalling and loss of section.

(5) Some minor log debris in the downstream channel.

The hydraulic analysis reveals that the dam cannot pass the required test flood.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency. This dam is generally fair condition. The recommendations and remedial measures presented in Section 7.2 and 7.3 should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

d. Need for Additional Investigation. No additional investigation is needed to complete Phase I.

7.2 Recommendations

The owner should engage a qualified engineer to investigate the seepage conditions where the embankment sections abut the concrete section of the dam and to design remedial or control measures as needed. Due to the dam's small size

and low hazard classification, no further hydraulic analysis is recommended.

7.3 Remedial Measures

(a) Grassy vegetation on the crest of the embankment sections of the dam should be established.

(b) Seepage should be monitored weekly until permanent remedial or control measures are implemented.

(c) The deteriorated concrete spillway section should be repaired.

(d) The downstream channel should be cleaned of log debris.

(e) A written operational procedure and warning system to follow in the event of flood flow conditions or imminent dam failure should be developed.

(f) The technical inspection program should be continued on a yearly basis.

7.4 Alternatives

There are no practical alternatives to the recommendations of Sections 7.2 and 7.3.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Buck Street West Dam

DATE November 16, 1978

TIME 10:00 A.M.

WEATHER Sunny, Cool

W.S. ELEV. 283.1 U.S. 280.0 DN.S

PARTY:

1. Gordon Slaney
2. Stan Mazur
3. Ronald Hirschfeld
4.
5.
6.
7.
8.
9.
10.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dam	Ronald Hirschfeld	
2.	Spillway/Outlet Works	Gordon Slaney, Stan Mazur	
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT Buck Street West Dam DATE November 16, 1978

PROJECT FEATURE Dam NAME R. Hirschfeld

DISCIPLINE Geotechnical Engineer NAME

AREA EVALUATED	CONDITION
DAM EMBANKMENT	Short embankment section from end of concrete overflow section to each abutment.
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	None apparent.
Pavement Condition	Not paved.
Movement or Settlement of Crest	None apparent.
Lateral Movement	None apparent.
Vertical Alignment	Good.
Horizontal Alignment	Good.
Condition at Abutment and at Concrete Structures	Fair.
Indications of Movement of Structural Items on Slopes	None apparent.
Trespassing on Slopes	Foot traffic on crest.
Sloughing or Erosion of Slopes or Abutments	Recently placed sand and gravel on crest of dikes at both abutments.
Rock Slope Protection - Riprap Failures	Roughly laid boulders on downstream face at east abutment, placed cut stone on downstream face of west abutment.
Unusual Movement or Cracking at or near Toes	None.
Unusual Embankment or Downstream Seepage	Small seepage at toe of dike adjacent to concrete stoplog structure at west end; rust staining, apparently due to seepage at toe of dike adjacent to concrete gravity section at east end.
Piping or Boils	None.
Foundation Drainage Features	None apparent.
Toe Drains	None apparent.
Instrumentation System	None.
Vegetation	No vegetation on crest of dikes at both ends. Concrete wall against upstream face of both dikes. Roughly laid boulders on downstream face of east dike. Placed cut stone on downstream face of west dike.

PERIODIC INSPECTION CHECK LIST

PROJECT Buck Street West Dam DATE November 16, 1978

PROJECT FEATURE Intake Channel/Structure NAME R. Hirschfeld

DISCIPLINE Structural/Hydraulic/Geotechnical Engineers NAME S. Mazur, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Good.
Bottom Conditions	Good, bedrock with some sand, gravel, and boulders.
Rock Slides or Falls	None.
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	None.
b. Intake Structure	
Condition of Concrete	Sluiceway structure, concrete fascia, good condition.
Stop Logs and Slots	Good.

PERIODIC INSPECTION CHECK LIST

PROJECT Buck Street West Dam DATE November 16, 1978

PROJECT FEATURE Control Tower NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL TOWER	This facility has no tower.
a. Concrete and Structural	
General Condition	
Condition of Joints	
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
b. Mechanical and Electrical	
Air Vents	
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	
Emergency Gates	
Lightning Protection System	
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECK LIST

PROJECT Buck Street West Dam DATE November 16, 1978

PROJECT FEATURE Transition and Conduit NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	None.
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	

PERIODIC INSPECTION CHECK LIST

PROJECT Buck Street West Dam — DATE November 16, 1978

PROJECT FEATURE Outlet Structure/Channel — NAME R. Hirschfeld

DISCIPLINE Structural/Hydraulic/Geotechnical Engineers — NAME S. Mazur, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Sluiceway, which is only way of outletting water other than the spillway, consists of hand-removable wooden stoplogs and concrete in good condition.
General Condition of Concrete	
Rust or Staining	
Spalling	Some spalling at sluiceway structure fascia concrete.
Erosion or Cavitation	
Visible Reinforcing	Visible reinforcing at the side of the fascia concrete. Appears to be left exposed for the future extension of the fascia concrete (Photo 13).
Any Seepage or Efflorescence	
Condition at Joints	None.
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	Some trees overhanging channel, but channel is broad.
Condition of Discharge Channel	Good.

PERIODIC INSPECTION CHECK LIST

PROJECT Buck Street West Dam — DATE November 16, 1978

PROJECT FEATURE Spillway/Channel — NAME R. Hirschfeld

DISCIPLINE Structural/Hydraulic/Geotechnical Engineers — NAME S. Mazur, G. Slaney

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	Concrete gravity overflow section (Main Dam).
a. Approach Channel	
General Condition	Good.
Loose Rock Overhanding Channel	None.
Trees Overhanging Channel	Some trees, but channel is wide.
Floor of Approach Channel	Bedrock with some sand, gravel and boulders.
b. Weir and Training Walls	
General Condition of Concrete	Surface concrete of spillway weir structure is in poor condition (Photos 6 and 7).
Rust or Staining	Rusty stain was noted over spillway surface.
Spalling	Heavy spalling.
Any Visible Reinforcing	None observed.
Any Seepage or Efflorescence	None observed.
Drain Holes	None.
c. Discharge Channel	
General Channel	Good.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	Some trees, but channel is wide.
Floor of Channel	Bedrock, with some boulders.
Other Obstructions	Some brush and logs in channel.

PERIODIC INSPECTION CHECK LIST

PROJECT Buck Street West Dam DATE November 16, 1978

PROJECT FEATURE Service Bridge NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	None.
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat & Backwall	

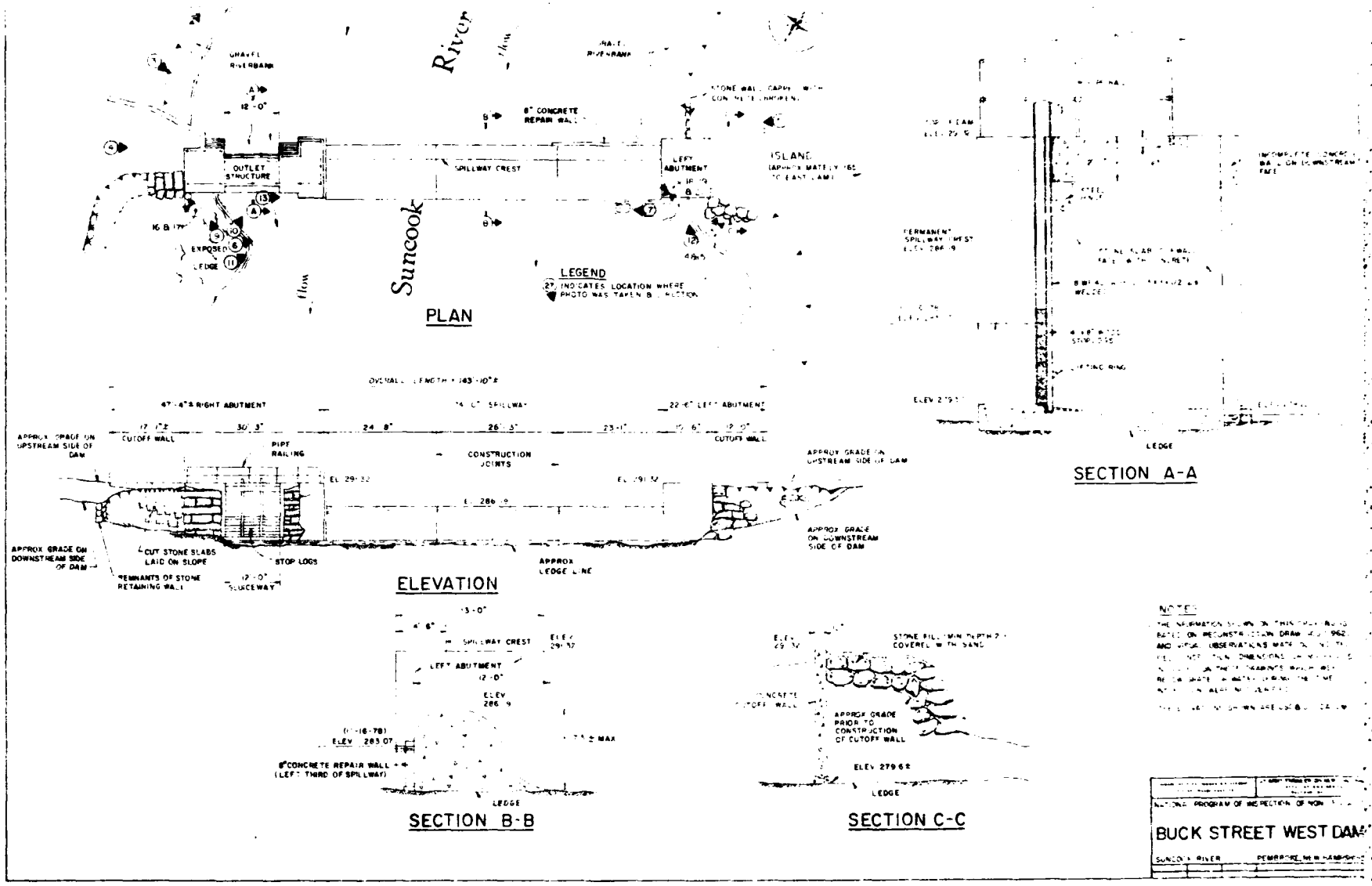
APPENDIX B

ENGINEERING DATA

1. LIST OF DESIGN, CONSTRUCTION AND MAINTENANCE RECORDS
2. PAST INSPECTION REPORTS
3. PLAN AND DETAILS

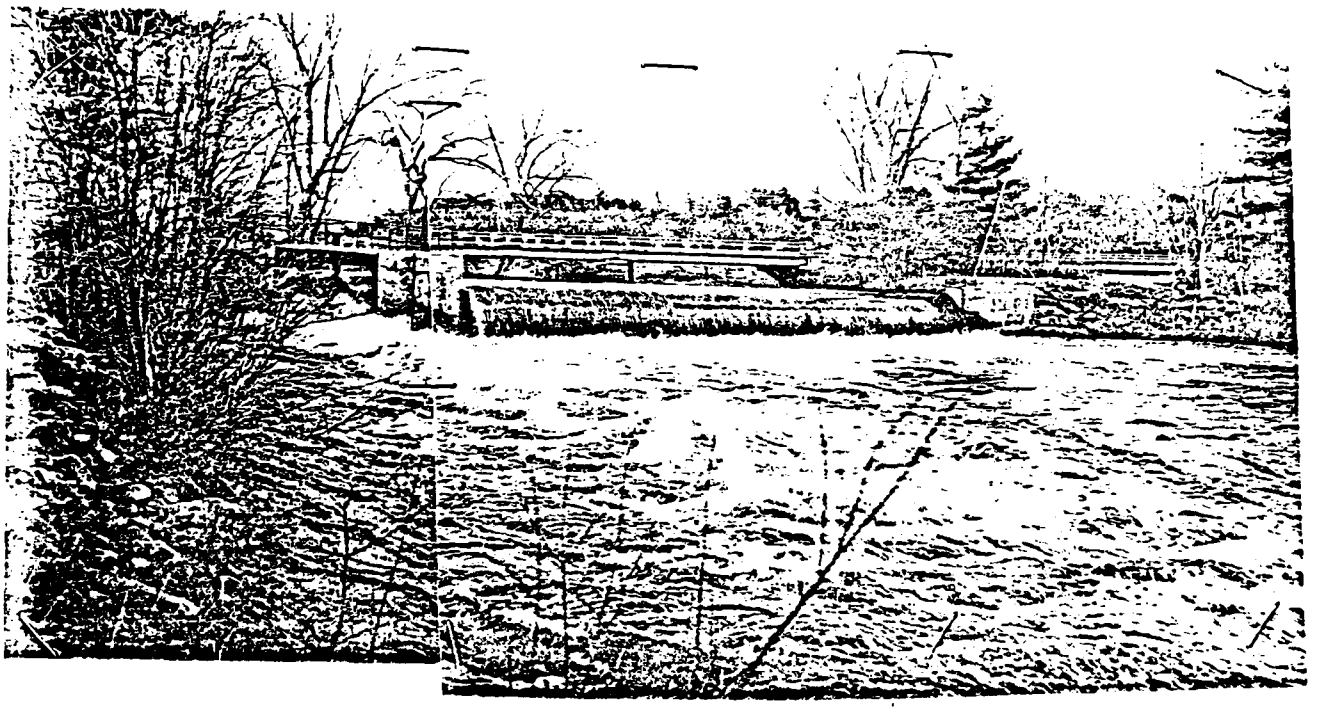
AVAILABLE ENGINEERING DATA

A set of drawings (10 sheets), dated 1961 and 1962, showing plans and details of the additions and improvements made to the dam in 1962 is avalable at the State of New Hampshire Water Resources Board, 37 Pleasant Street, Concord, New Hampshire 03301.


Suncook River
Flow
GRAVEL RIVERBANK
STONE WALL CAPPED WITH CONCRETE (IMPERV.)
8" CONCRETE REPAIR WALL
OUTLET STRUCTURE
SPILLWAY CREST
LEFT ABUTMENT
ISLAND
EXPOSED LEDGE
LEGEND
(27) INDICATES LOCATION WHERE PHOTO WAS TAKEN & DIRECTION
PLAN
OVERALL LENGTH = 283'-10"±
47'-4" RIGHT ABUTMENT
22'-6" LEFT ABUTMENT
CUTOFF WALL
PIPE RAILING
CONSTRUCTION JOINTS
APPROX GRADE ON UPSTREAM SIDE OF DAM
APPROX GRADE ON DOWNSTREAM SIDE OF DAM
CUT STONE SLABS LAID ON SLOPE
STOP LOGS
REMNANTS OF STONE RETAINING WALL
SLUICEWAY
APPROX LEDGE LINE
ELEVATION
SPILLWAY CREST
LEFT ABUTMENT
8"CONCRETE REPAIR WALL (LEFT THIRD OF SPILLWAY)
SECTION B-B
STONE FILL MIN DEPTH 2' COVERED WITH SAND
CONCRETE CUTOFF WALL
APPROX GRADE PRIOR TO CONSTRUCTION OF CUTOFF WALL
ELEV 279.6±
LEDGE
SECTION C-C
PERMANENT SPILLWAY CREST
STEEL PILE
SECTION A-A
NOTES
BUCK STREET WEST DAM
SUNCOOK RIVER
PEMBROKE, NEW HAMPSHIRE

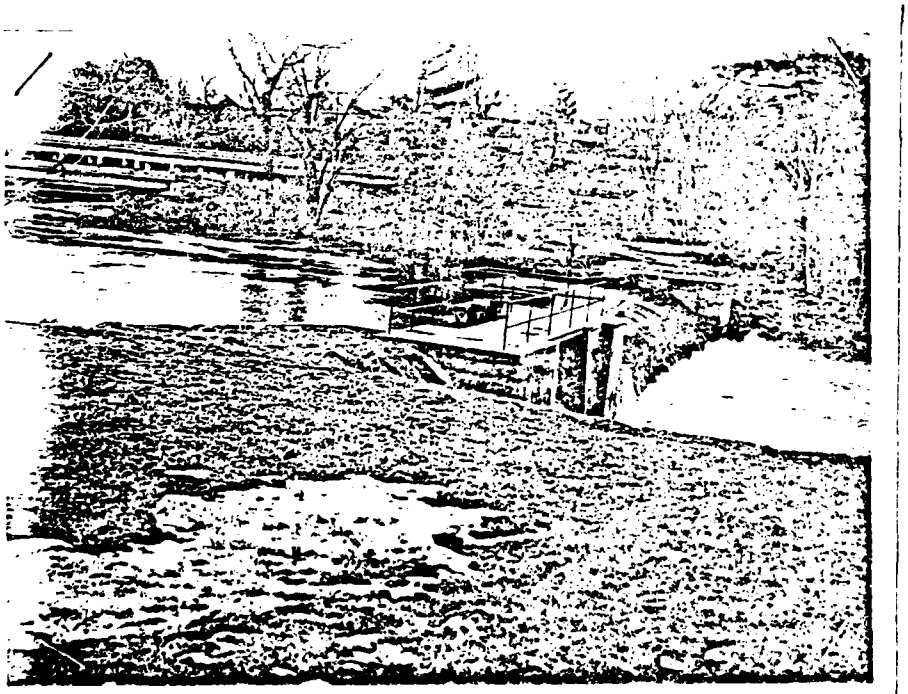
FIGURE

PAST INSPECTION REPORTS



BUCK STREET FALL, FREDERIC

April 4, 1963



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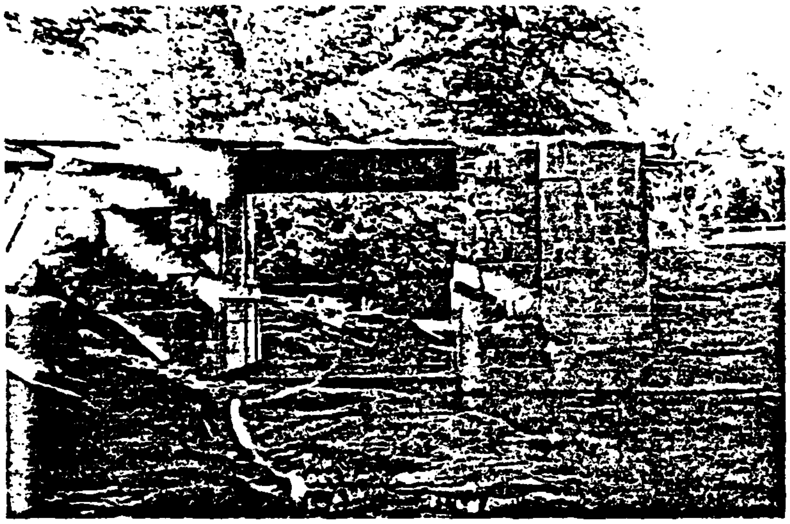

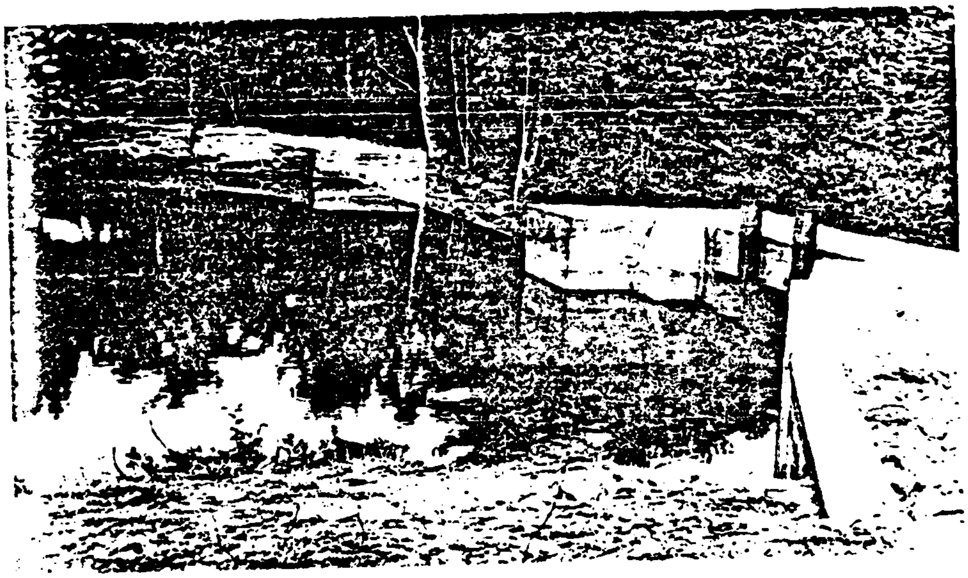

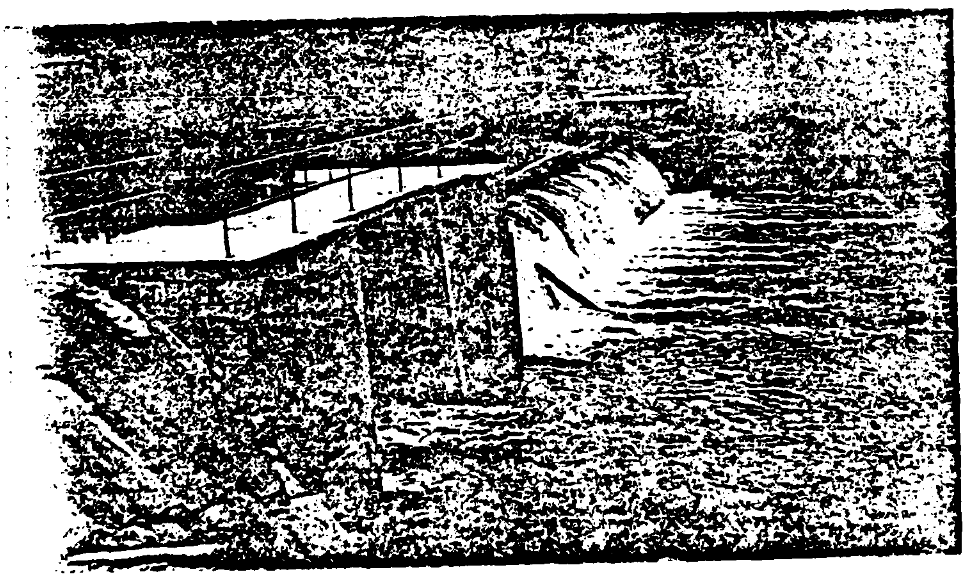

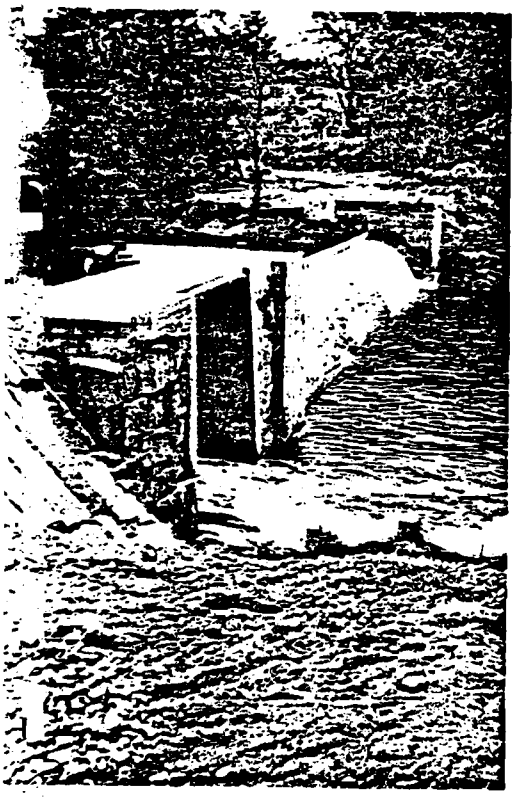

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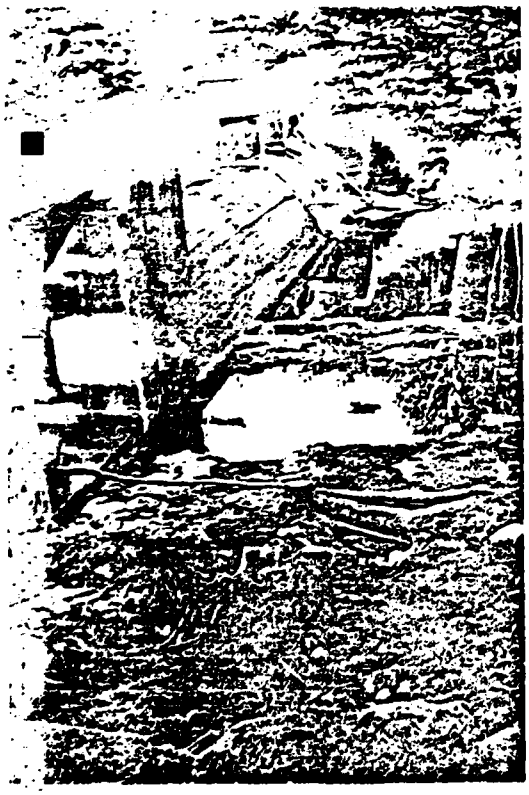

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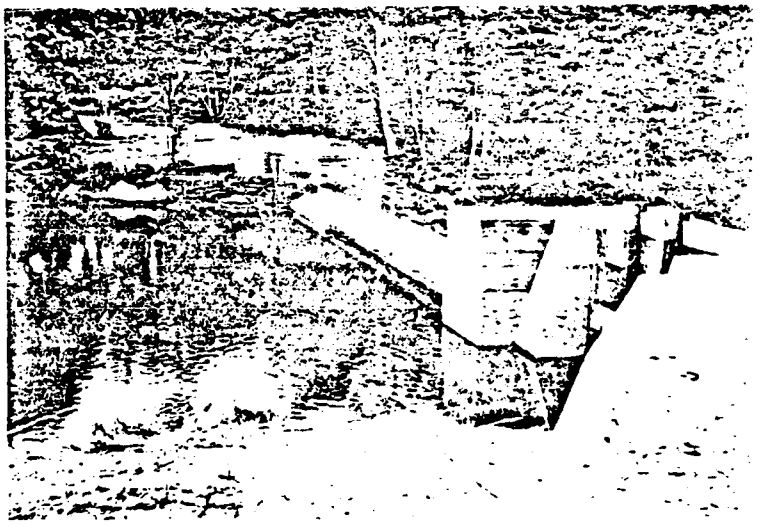


V. BRUCE DAVIS
LANE'S END - PEMBROKE, N. H.
P. O. SUNCOOK - R. F. D. #1

Aug. 10, 1962

N. H. Resources Board,
Concord, N. H.

Att. Mr. Frost

Gentlemen,

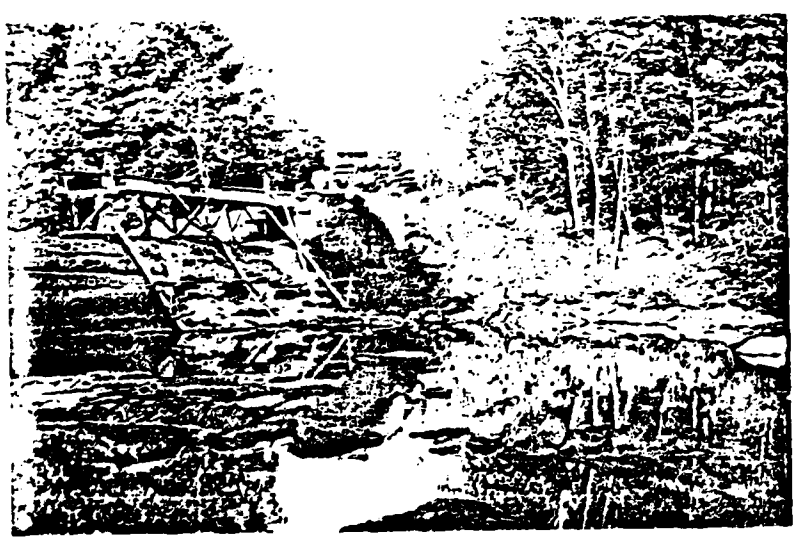
Enclosed please find some photos I took of the dam, near my home, while under construction repairs.

I thought they would be helpful for your dept.

If you will let me know when the time will be convenient for Mr. White and yourself, I will be pleased to meet you at my home or in Concord.

Sincerely,
V. Bruce Davis.

JUL • 62



NEW HAMPSHIRE WATER CONTROL COMMISSION

REPORT ON DAM INSPECTION

TOWN _____ DAM NO. 1005 STREAM _____

OWNER _____ ADDRESS _____

In accordance with Section 20 of Chapter 133, Laws of 1937, the above dam was inspected by me on _____ ~~accompanied by~~ _____

NOTES ON PHYSICAL CONDITION

Abutments _____

Spillway _____

Gates _____

Other _____

CHANGES SINCE LAST INSPECTION _____

FUTURE INSPECTIONS _____

This dam (~~is~~ (is not) a menace because _____

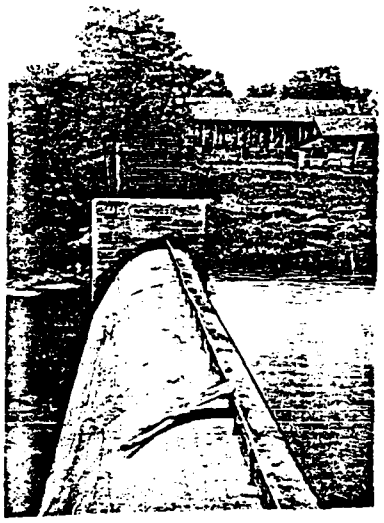
REMARKS _____

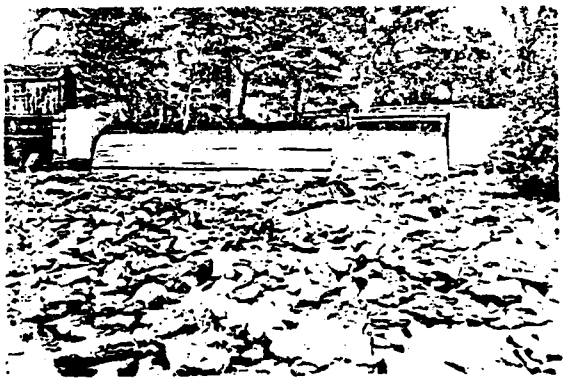
Copy to Owner	Date

_____
INSPECTOR

(Additional Notes Over)

SUNCOOK RIVER IN PEMBROKE
Suncook Mills
August 2,1934





APPENDIX C

PHOTOGRAPHS

FOR LOCATION OF PHOTOS, SEE FIGURE 1
LOCATED IN APPENDIX B

PHOTO NO. 1 - Series of two photos (1 & 2) taken clockwise from unused highway bridge upstream of dam, showing left abutment, concrete spillway section, sluiceway structure and right abutment.

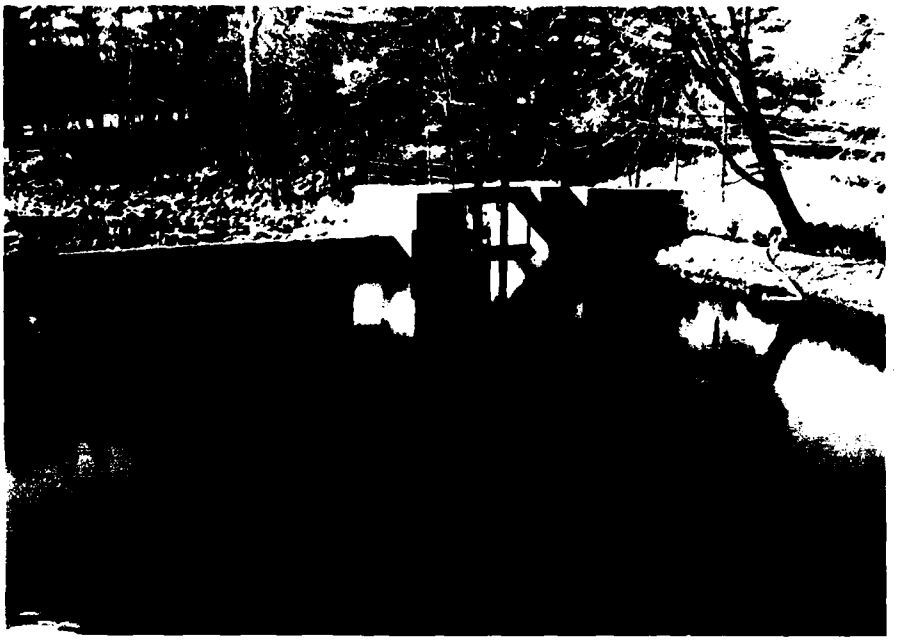


PHOTO NO. 2 - Sluiceway structure and right abutment.

PHOTO NO. 3 - Upstream face of dam from right side of reservoir.

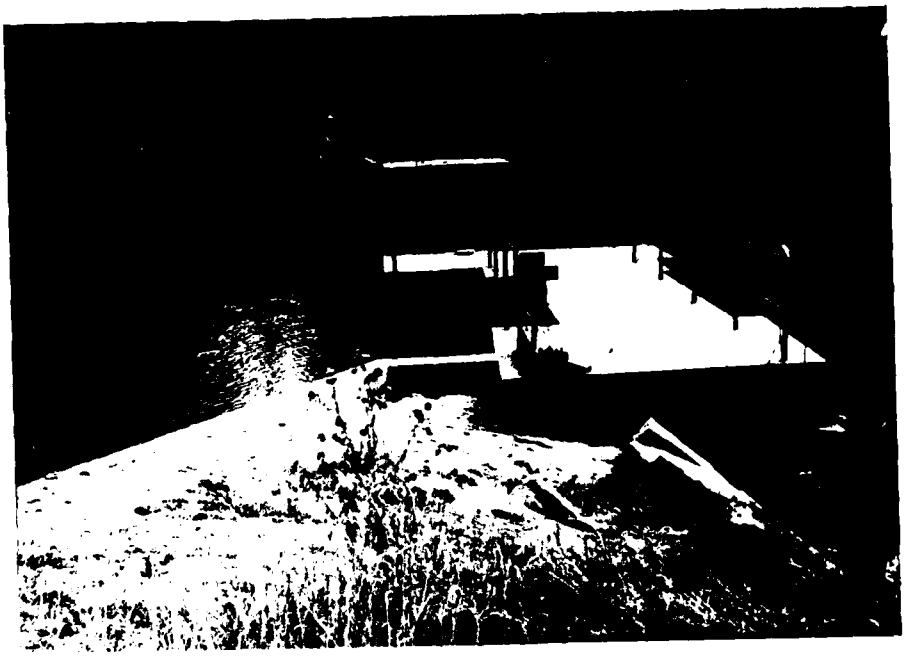


PHOTO NO. 4 - View of dam from right abutment.

PHOTO NO. 5 - View of dam from left abutment.

PHOTO NO. 6 - View of downstream face of concrete spillway section.

PHOTO NO. 7 - Close-up of concrete surface at downstream face of spillway.

PHOTO NO. 8 - Upstream face of sluiceway structure.

PHOTO NO. 9 - Series of four photos (9, 10, 11 & 12) taken clockwise from discharge channel showing right abutment, sluiceway structure, spillway structure and right abutment.

PHOTO NO. 10 - (See Photo No. 9).

PHOTO NO. 11 - (See Photo No. 9).

PHOTO NO. 12 - (See Photo No. 9).

PHOTO NO. 13 - Close-up of sluiceway wall structure. Note exposed reinforcing steel.

PHOTO NO. 14 - Sequence of two photos (14 & 15) taken clockwise showing rust-staining at toe of east end of concrete-gravity overflow section and adjacent embankment. No water flowing at time of inspection. Swamp grass in Photo No. 16.

PHOTO NO. 15 -

PHOTO NO. 16 - Series of two photos (16 & 17) taken clockwise showing minor seepage at right abutment.

PHOTO NO. 17 -

PHOTO NO. 18 - Series of three photos (18, 19 & 20) taken clockwise from east abutment showing downstream channel.

PHOTO NO. 19 - (See Photo No. 18).

PHOTO NO. 20 - (See Photo No. 18).

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RY	Date 11/22/78	Job No 5628-11-17
	Checked by	Date	Sheet No 1
For BUCK STREET WEST DAM			

HYDRAULICS & HYDROLOGY

Buck Street West Dam is located in Pembroke, NH across the Suncook, River in the Merrimack River Basin.

CLASSIFICATION Size : Small
Hazard : low

Basic Data D.A. = 240 sq.mi. (HNTB checked)
Upstream Basin: Flat-coastal

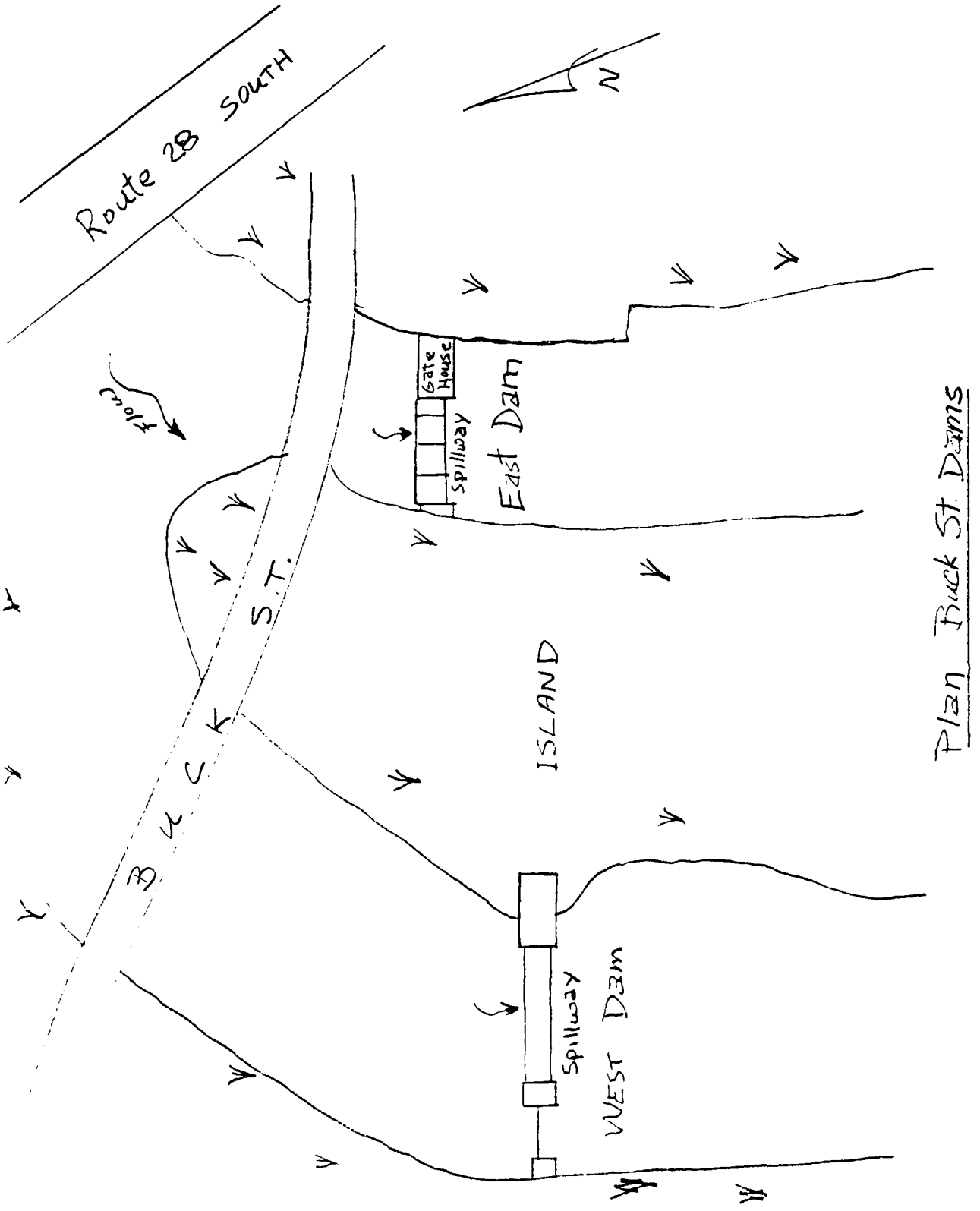
Reservoir: Normal storage : elev. 284.4
84 acre-ft
Max. Storage : elev 291.0
400 acre-ft
Surface area
Normal - 25 acres
Max. - 70 acres

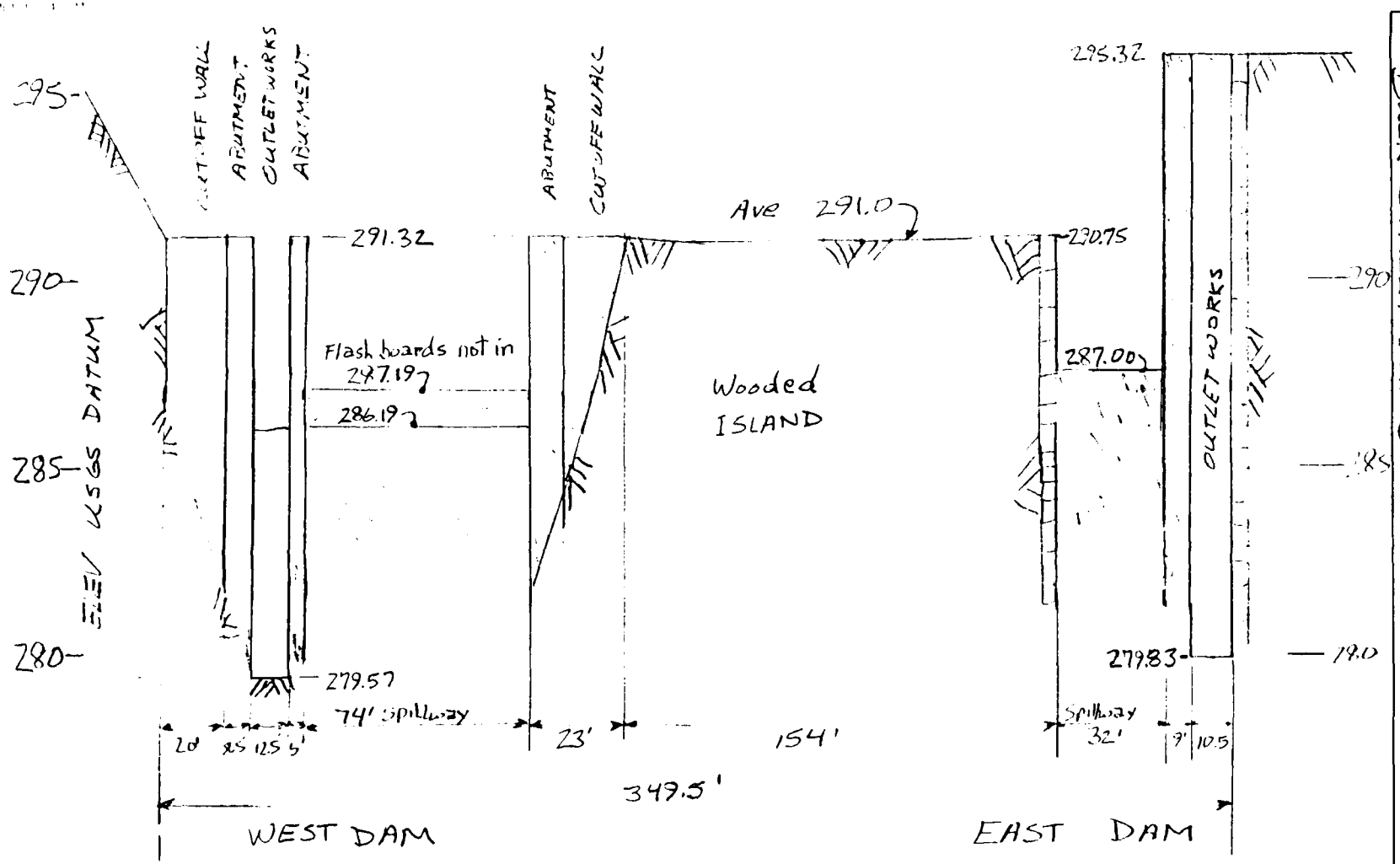
Dam Concrete-gravity
Length : 143 ft
Height : 11.75 ft

Spillway concrete
Length 74 ft
Crest elev. 286.19

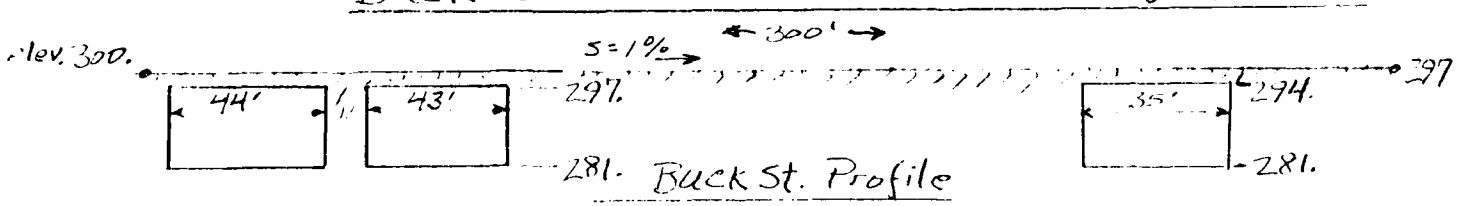
Outlet : concrete invert w/ piers
3 openings 2@ 3.88 ft
1@ 4.23 ft

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RY	Date 11/27/78	Job No 5628-11-
	Checked by	Date	Sheet No 2
For BUCK ST.			





BUCK STREET DAMS X-Section Looking upstream



Buck St. Profile

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF
For BUCK STREET DAMS

Made by	RY
Checked by	
Date	11/22/78
Job No.	5628-11
Sheet No.	3

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by RY	Date 12/1/78	Job No 5628-11-.
	Checked By	Date	Sheet No 4

For BUCK STREET

Step 1 Calculation of Spillway Design Flood

Classification Size small
Hazard low

Hydrologic Evaluation Guideline recomends

SDF = 50 yr to 100 yr frequency

Size classification is in mid-range for storage capacity and low range for height.

Use 100 yr flood for SDF.

Gaging Sta at Chichester N.H. 157 sq mi D.A.

MAR 1936 Q 12,900 cfs Max discharge

100 yr Flood Discharge from: "Water Resources Investigation Merrimack River Basin" C.O.E. Waltham, Ma., August 1972
TABLE C-17 in Appendices

100 yr discharge Natural Flood Peak = 12,100 cfs

$$\frac{12100 \text{ cfs}}{157 \text{ sqmi}} = 77 \text{ csm}$$

At BUCK STREET D.A. = 240 sq mi.

77 csm x 240 sq mi. = 18,480 cfs

USE 18500 cfs for SDF

Step 3 Calculation of Surcharge

Spillway Design Flood = 18,500 cfs

As the Buck Street Dams are hydraulically interconnected the following calculations to develop the stage-discharge curve include the spillways of both dams.

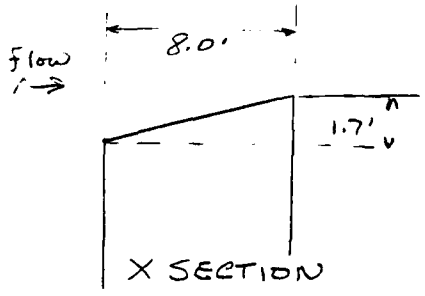
At the East Consider:
1. Gate closed.
2. Gate house is the easterly boundry of flow.

At the West Dam consider
1. Stop logs in place to elev. 286.19.
2. End of westerly cutoff wall west flow boundry.

General Considerations
1. Negligible flow over island as it is heavily wooded and of varying elevations.

East Dam

Spillway $Q_E = CLH_E^{3/2}$



$C = 3.38$

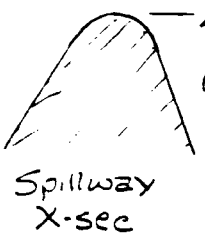
$L = 32'$

$Q_E = 3.38(32) H_E^{3/2}$

$Q_E = 108 H_E^{3/2}$

West Dam

Stop logs in outlet works to elev 286.19 same as spillway crest elevation. To simplify calculation consider flow over stop logs in outlet works as part of spillway flow.



$$Q_w = C L H_w^{3/2}$$

$L_{spillway} = 74$ ft.

$L_{OUTLET} = 12$ ft

$$Q_w = 3.75(13+74) H_w^{3/2}$$

$$Q_w = 326 H_w^{3/2}$$

In addition to the spillway there is an additonal 56.5ft of abutment and cutoff wall facing upstream Use broad crested weir hydraulics

$$Q_A = C L H_A^{3/2}$$

crest elevation of walls & abutments
291.32 use 291.3
$C = 2.65$
$L = 56.5$

$$Q_A = 2.65(56.5) H_A^{3/2} = 150 H_A^{3/2}$$

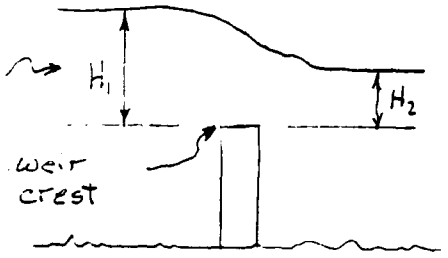
TABLE 1
Stage - Discharge

Water Surface	H_E	Q_E	H_W	Q_W	H_A	Q_A	Q_T
290.75	3.75	785	4.55	3165	-	-	3950
291.30	4.30	965	5.10	3755	-	-	4720
293.0	6.0	1585	6.8	5780			7365
			D.S T.W. Submerges both spillways				

Submerged Weirs

$$Q = Q_1\left[1-\left(\frac{H_2}{H_1}\right)^{1.5}\right]^{.385}$$

Q = ACTUAL DISCHARGE
Q_1 = Free Discharge
H_2 = Head above weir downstream side
H_1 = Head used for Q_1



H_2 = TW elev − weir crest

DAM	weir crest
East	287.0
West	286.2
Abut'mt's	291.3

Section	H_1	H_2
WEST DAM ABUTMENTS	H + 0	TW − 291.3
EAST DAM	H + 4.3	T.W. − 287.0
WEST DAM	H + 5.1	TW. − 286.2

Solve: weir submergence equation trial & error

$$Q_T = \Sigma Q_1\left[1-\left(\frac{H_2}{H_1}\right)^{1.5}\right]^{.385}$$

$$Q_T = 150H^{1.5}\left[1-\left(\frac{H_{2A}}{H}\right)^{1.5}\right]^{.385} + 108(H+4.3)^{1.5}\left[1-\left(\frac{H_{2E}}{H+4.3}\right)^{1.5}\right]^{.385} + 326(H+5.1)^{1.5}\left[1-\left(\frac{H_{2W}}{H+5.1}\right)^{1.5}\right]^{.385}$$

WEST DAM ABUTMENTS EAST DAM WEST DAM

1. From Fig 2 Find TW elev. For a given Total Q
2. Using T.W. calculate H_2 for each section
3. Assume upstream trial w.s. elevation, subtract abutment elevation to obtain H
4. Substitue values in above expression to obtain trial Q_T match to given Q, if equal, H + 291.3 = upstream w.s elevation

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

Made by RY	Date 12/1/78	Job No. 562-[illegible]
Checked by	Date	Sheet No. 8

For BUCK STREET

TABLE 2
stage - discharge
submerged weir

Elev	T.W. elev.	Q_T	Q_A	Q_E	Q_W
295.25	291.9	10,000 cfs	1155 cfs	2030 cfs	6815 cfs
296.65	293.4	12,000	1665	2400	7940
298.0	294.75	14,000	2180	2790	9130
300.65	297.3	18,500	3250	3610	11,640

Step 4 Effect of Surcharge Storage

MPFR = 19" MPF = 240 × 300 = 72,000 cf

100 yr R: $\frac{Q_{100}}{MPF} \times 19 = \frac{18500}{72000} \times 19 = 4.88$ in

$Q_{P_1} = 18{,}500$ cfs

Surcharge$_1$ = elev 300.65 − 286.2 = 14.45

Vol of surcharge

$$Stor_1 = \frac{\frac{1}{2}\left(\frac{14.45}{000}\right)(150 \times 14.45) \times 12 \text{ in/ft}}{43560 \text{ cu ft/acre ft} \times 640 \text{ acre/mi}^2 \; 240 \text{ sq mi}} = .05 \text{ in}$$

SEE pg. For storage vol computation

$$Q_{P_2} = Q_{P_1}\left(1 - \frac{Stor_1}{4.88}\right) = 18{,}500\left(1 - \frac{.05}{4.88}\right) = 18310 \text{ cfs}$$

Surcharge$_2$ = 14.25

$Stor_2 = (Surcharge_2)^2 \times (.000224) = .05$ in

$Stor_{AVE} = \frac{Stor_1 + Stor_2}{2} = \frac{0.05 + .05}{2} = .05$ in

$Qp_3 = Qp_1\left(1 - \frac{Stor_{AVE}}{488}\right) = 18{,}500\left(1 - \frac{.05}{488}\right) = 18310$ cfs

Stor values within <1% use Qp_3 as outflow

Outflow = 18,310 cfs

Stage 300.45 or 14.25 ft above west Dam spillway

At the spillway design flood 18310 cfs

West Dam - 14890 cfs 82%

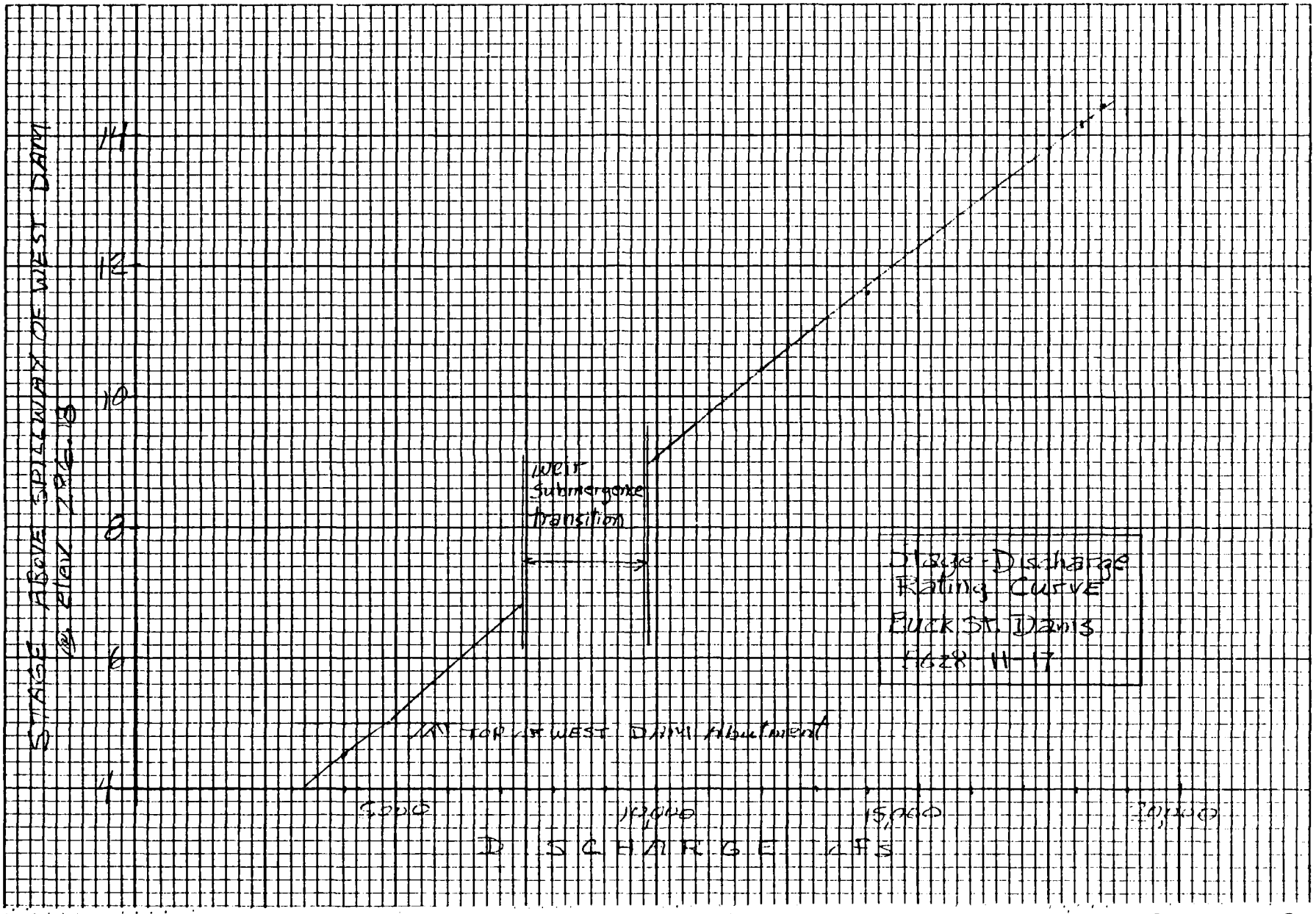
East Dam - 3,420 cfs 18%

Conclusions

1. Both Buck St. East & Buck St West act together hydraulically as one dam across the Suncook River.
2. The spillway & storage capacity of both dams combined can safely pass 23% of the test flood. of 18,310 cfs

Combined Spillways	4720 cfs.
East Dam	965 cfs
West Dam	3755 cfs

3. Reservoir storage will reduce the SDF at the outlet from 18500 cfs to 18,310 cfs or by 1.7%.
4. At the test discharge of 18,310 cfs the East Dam crest will be overtopped by 9.7 ft and the west Dam crest by 9.15 ft.



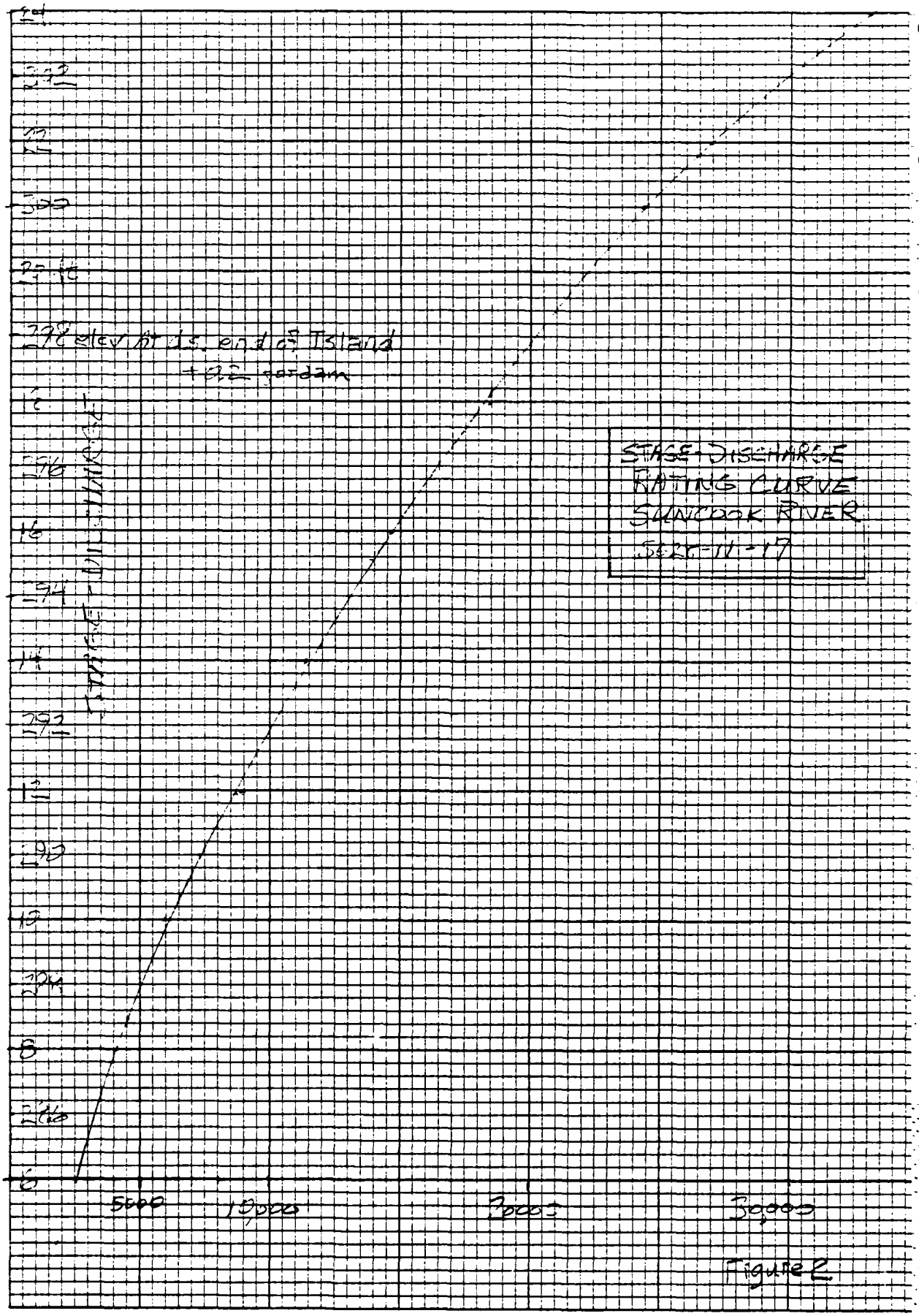


Figure 2

HNTB HOWARD NEEDLES TAMMEN & BERGENDOFF	Made by EY	Date 11/13/98	Job No 5628-11-17
	Checked by [illegible]	Date [illegible]	Sheet No 10
For BUCK STREET WEST			

Estimate of Downstream Dam Failure Hydrograph

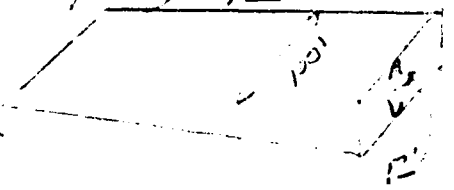
by "Rule of Thumb METHOD"

Step 1 Estimate of Reservoir Storage at time of failure:

No data on reservoir volume estimate

Ave streambed slope near dam
0.0006 ft/ft USGS
Stream width 100'
Depth at dam (Normal pool) = 12'

$$\frac{\frac{1}{2}\left(\frac{6.6}{.0006}\right)(100)(6.6)}{43560\ \text{ft}^3/\text{acre-ft}} = 84\ \text{acre-ft}$$



Max. Storage at crest of dam
Depth 11.8 ft

$$\frac{\frac{11.8}{.0006}\left(\frac{150' \times 11.8}{2}\right)}{43560\ \text{ft}^3/\text{acre-ft}} = 400\ \text{acre-ft}$$

Max Storage 400 acre-ft

Use 400-84 or 316 acre ft Net Storage

Step 2 Peak Failure Outflow

$$Q_p = \frac{8}{27}\sqrt{g}\, b_c\, y_o^{3/2}$$

b_c = width of breach = 150' = dam width

y_o = Total depth from [illegible]

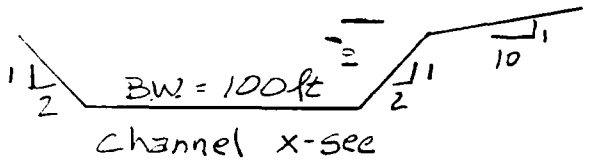
$$Q_{P_1} = \frac{8}{27}\sqrt{g}\,(.40)(132)(12)^{3/2} = 3700 \text{ cfs}$$

Step 3 Stage-Discharge

$S = 0.0006'/'$

$L = 19{,}500$ ft

$n = 0.03$ channel
0.08 OVER BANK



Stage	Discharge
5'	1820 cfs
8'	4070
10'	5970
11'	7200
12'	8500

Step 4 Reach Outflow

$L_1 = 6500'$

$Q_{P_1} = 3700$ cfs $\text{Stage}_1 = 7.75$ ft

$\text{Area}_1 = 895$ sq. ft.

$$V_1 = \frac{6500 \times 895}{43{,}560} = 133 \text{ acre-ft} < \frac{316}{2}$$

Reach length O.K.

$$Q_{P_2\,TRIAL} = Q_{P_1}\left(1 - \frac{V_1}{5}\right) = 3700\left(1 - \frac{133}{322}\right) = 2165 \text{ cfs}$$

$\text{Stage}_2 = 5.65$ ft $\text{Area}_2 = 630$ □'

$$V_2 = \frac{630 \times 6500}{43{,}560} = 94 \text{ acre-ft}$$

$$V_{AVE} = \frac{V_1 + V_2}{2} = \frac{133+94}{2} = 114 \text{ acre-ft}$$

$$Q_{P_2} = Q_{P_1}\left(1 - \frac{V_{AVE}}{S}\right) = 3700\left(1 - \frac{114}{322}\right) = 2390 \text{ cfs}$$

Outflow = 2390 cfs Stage = 5.80 ft

Step 5 Reach 2 Characteristics Same as reach 1

$L_2 = 10{,}000'$ $Q_{P_1} = 2390$ cfs $Stage_1 = 5.8$ ft $Area_1 = 647$ ft²

$L_{TOTAL} = 16{,}500'$ $V_1 = \frac{10{,}000\,(647)}{43{,}560} = 148$ acre-ft $< \frac{316}{2}$

Reach length Close to ½ limit OK

$$Q_{P_{2\,TRIAL}} = Q_{P_1}\left(1 - \frac{V_1}{S}\right) = 2390\left(1 - \frac{148}{316}\right) = 1291 \text{ cfs}$$

$Stage_2 = 4.1$ ft $Area_2 = 445$ ft²

$$V_2 = \frac{445 \times 10{,}000}{43560} = 102 \text{ acre-ft}$$

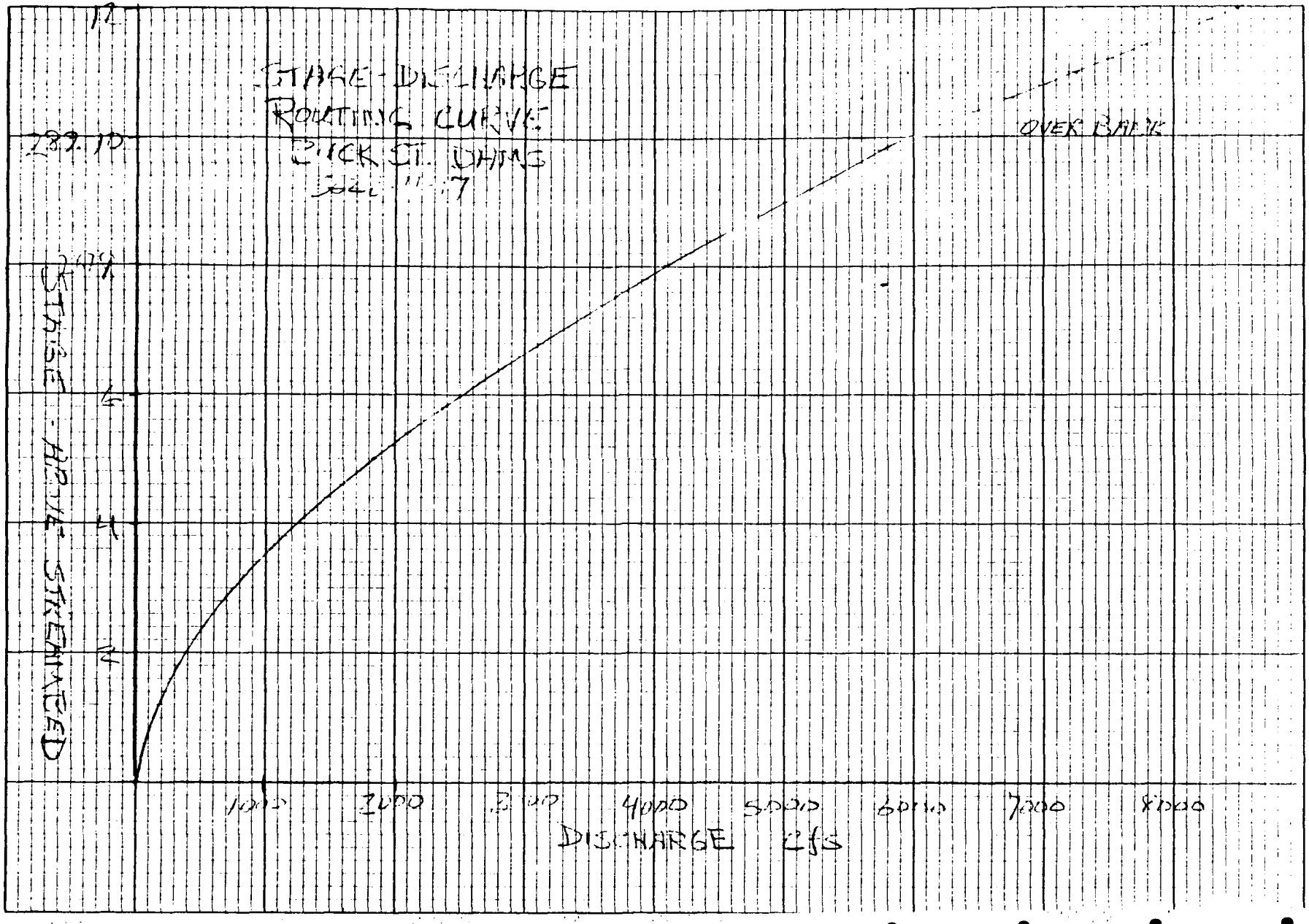
$$V_{AVE} = \frac{148 + 102}{2} = 125 \text{ acre-ft}$$

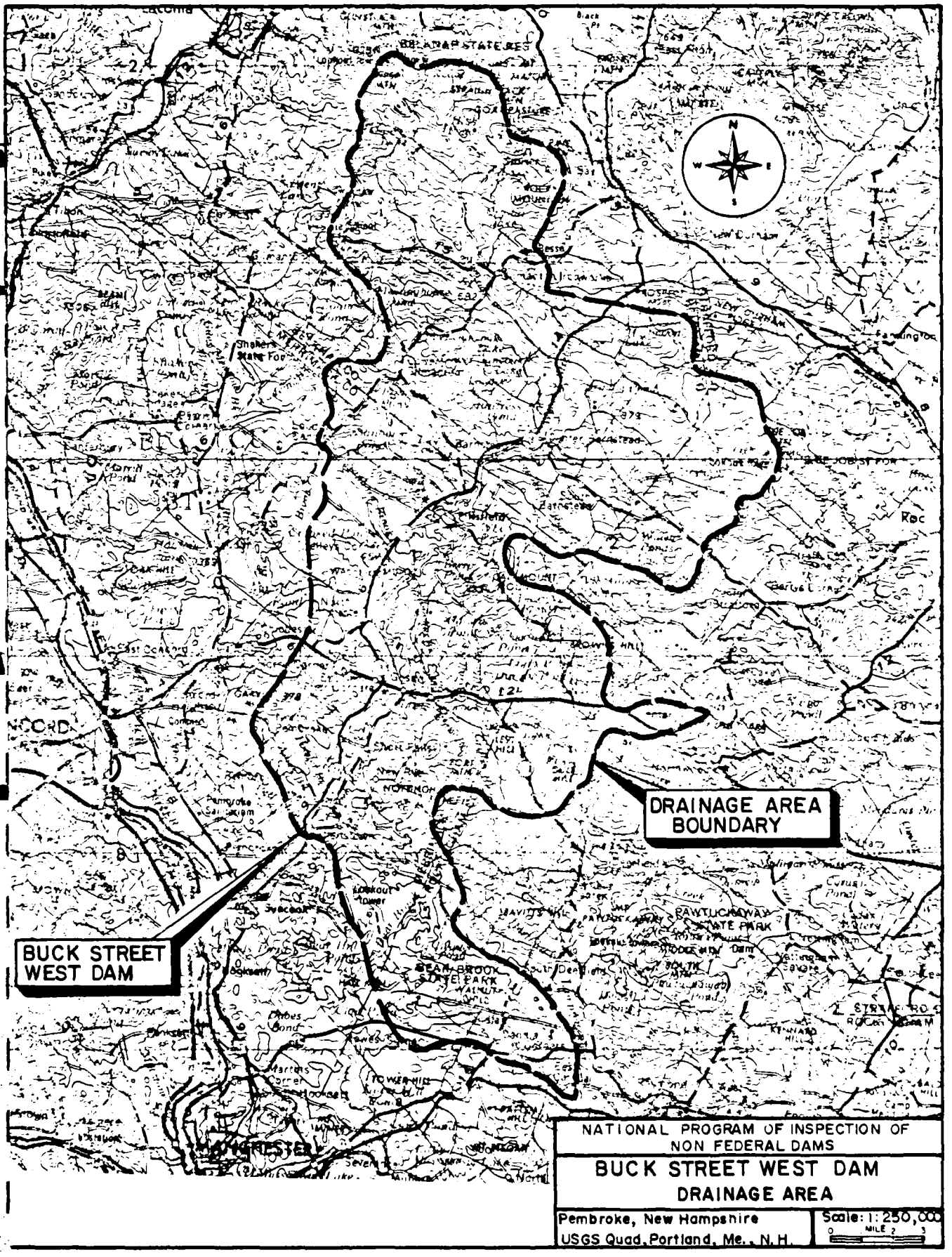
$$Q_{P_2} = 2390\left(1 - \frac{125}{316}\right) = 1440 \text{ cfs}$$

Outflow 1440 cfs Stage 4.3 ft

SUMMARY

End of Reach	Stage
At dam	7.75 ft
6500' d.s. of dam	5.8 ft
16,500' d.s. of dam	4.3 ft



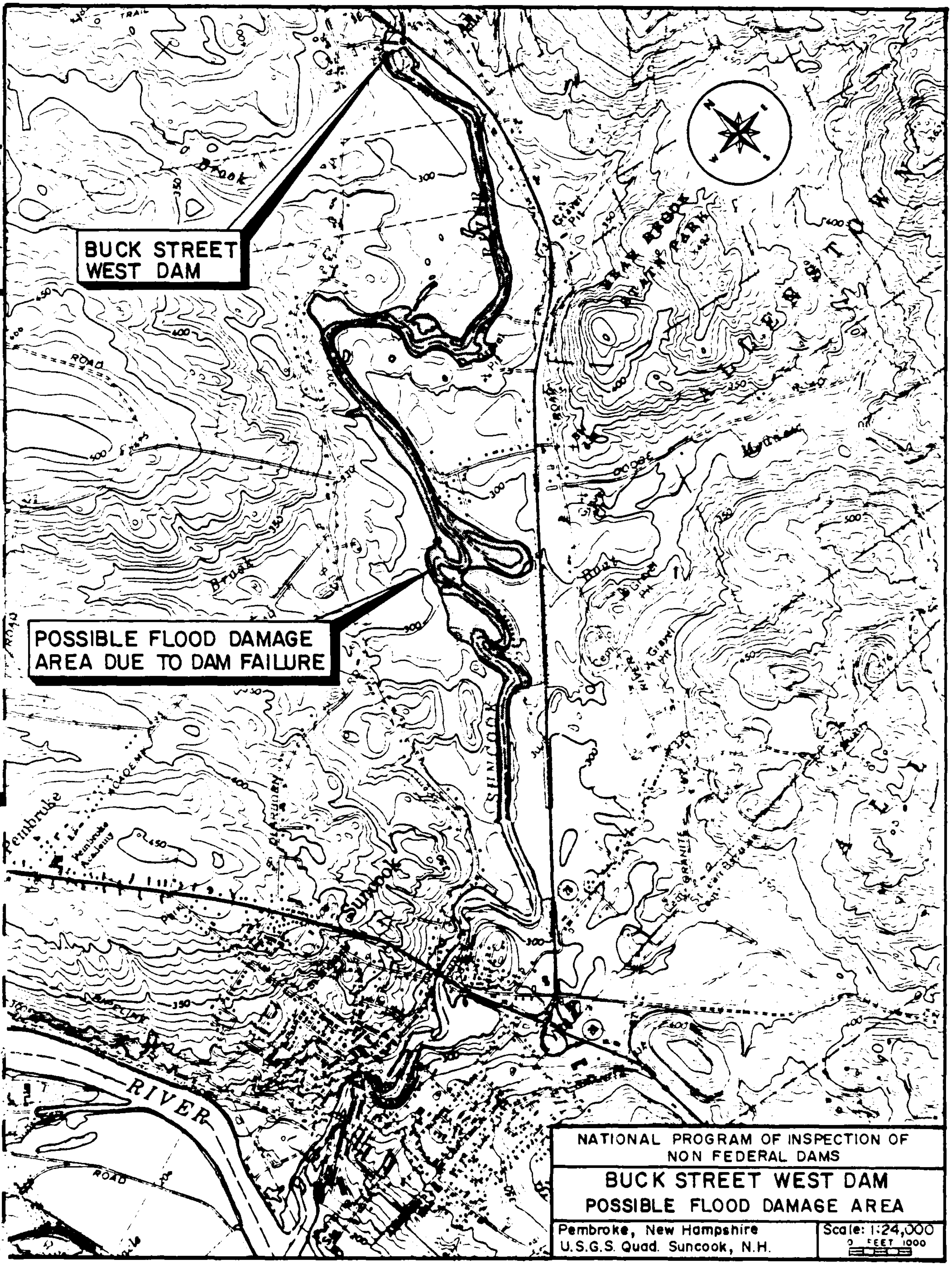


NATIONAL PROGRAM OF INSPECTION OF NON FEDERAL DAMS

BUCK STREET WEST DAM
DRAINAGE AREA

Pembroke, New Hampshire
USGS Quad, Portland, Me., N.H.

Scale: 1: 250,000
0 MILE 2 3


BUCK STREET
WEST DAM
POSSIBLE FLOOD DAMAGE
AREA DUE TO DAM FAILURE
RIVER
Pembroke
NATIONAL PROGRAM OF INSPECTION OF
NON FEDERAL DAMS
BUCK STREET WEST DAM
POSSIBLE FLOOD DAMAGE AREA
Pembroke, New Hampshire
U.S.G.S. Quad. Suncook, N.H.
Scale: 1:24,000
0 FEET 1000

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
				15	2				[illegible] STREET WEST DAM	[illegible]	7124.5	12	DEC	78

POPULAR NAME	NAME OF IMPOUNDMENT
[illegible] STREET WEST DAM	

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY – TOWN – VILLAGE	DIST FROM DAM (MI.)	POPULATION
1	S	SOUTH RIVER	PEMBROKE	5	4201

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE – FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE – FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VLR/DATE
[illegible]	1925	R	12	12	413	84	FED	N	N	N	N	21FEB79

REMARKS
1=1925 21=CONCRETE 22=REPAIRED 1964

D.S HAS	SPILLWAY TYPE	WIDTH (FT.)	MAXIMUM DISCHARGE (F.T.)	VOLUME OF DAM (CY.)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (F.T.)	WIDTH (F.T.)	LENGTH (F.T.)	WIDTH (F.T.)	LENGTH (F.T.)	WIDTH (F.T.)	LENGTH (F.T.)	WIDTH (F.T.)
		74	3750	230											

OWNER	ENGINEERING BY	CONSTRUCTION BY
[illegible] STATE RESOURCES BD	[illegible] WATER RESOURCES BD	NH FISH + GAME DEPT

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
[illegible]	[illegible]	[illegible]	[illegible]

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
[illegible] WATER RESOURCES BOARD	[illegible]		78	PUBLIC LAW 92-367 AUG 1972

REMARKS
[illegible] 33=HYDRAULICALLY CONNECTED TO ROCK EAST

END

FILMED

8-85

DTIC